The Effectiveness of Using a Pocket PC as a Video Modeling and Feedback Device for Individuals with Developmental Disabilities in Vocational Settings

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Abstract: This study evaluated the effectiveness of using a pocket PC to teach two adolescents with mild and moderate cognitive impairments vocational tasks in competitive, community-based settings. Participants were taught three different tasks in their respective work sites through video rehearsal and video feedback strategies. Video files were presented on a pocket PC prior to task engagement and following repeated errors (video feedback). Effectiveness of the video-based strategies and the utility of the handheld device were evaluated using a multiple probe design across tasks and participants. Outcomes of the study indicate that the introduction of the video-based procedures was associated with significant increases in independent responding and participants met criterion on all three tasks within 3-7 sessions (M=5 sessions). Although there were large changes in the level of data once the video-based materials were presented, outcomes are somewhat tempered by the fact that some of the baselines for each participant were slightly ascending prior to the introduction of the independent variable.

Keywords: Video technology, Handheld computers, Developmental disabilities, Vocational training

Vocational programming and support for individuals with developmental disabilities in competitive employment settings has received much attention in the last two decades (Lancioni, O'Reilly, Speedhouse, Furniss, & Cunha, 2000). The goal of vocational programming is to assist individuals with performing their job-related tasks as independently as possible so that they can have the means to support themselves in order to lead productive and self-sufficient lives. Fortunately, there has been a shift away from the assumption that individuals with developmental disabilities will work in sheltered employment settings and more attention and effort has been placed on supporting individuals in community-based vocational settings (Davies, Stock, & Wehmeyer, 2002a). As a result, much of the latest research relating to vocational programming has focused on strategies for increasing independence in job-related tasks. Because there has been a shift from sheltered to community-based settings, it is increasingly important to utilize self-management strategies that will promote task completion while reducing reliance on outside staff or job coaches (Agran, 1997).

To promote independent work-related behaviors and to decrease reliance on staff, several researchers have investigated the effectiveness of using supports and prompts such as picture cards and/or booklets, auditory prompts delivered electronic devices, and visual and auditory prompts delivered on handheld devices to promote self-directed work behaviors.

Several researchers have investigated the use of pictures to encourage self-directed task initiation and completion (Cihak, Alberto, Kessler, & Taber, 2004; Copeland & Hughes, 2000; Fisher, 1984; Martin, Mithaug, & Burger, 1990; Martin, Mithaug, & Frazier, 1992; Wacker & Berg, 1983). For example, Copeland and Hughes used a two-part picture prompt strategy to teach two high school students with severe disabilities to complete work-related skills (i.e., cleaning faculty dining room tables and sweeping; cleaning windows and a mirror in hallways of a hotel). The picture prompt strategy involved teaching participants to touch a picture to initiate a task and then turn a page in a booklet to indicate task completion. Results indicated that once participants acquired the picture prompt strategy, their independent task initiations (associated with picture touching) increased; however, task completion (which was associated with page turning) increased for only one of the participants. In a similar study, Wacker and Berg used a combination of demonstration, error correction, and praise to teach five individuals with moderate to severe disabilities to turn pages in a picture booklet to put together pieces of two different vocational assembly units (i.e., a black valve and circuit board). Once participants acquired the skills, the investigators withdrew all training components except the picture cues and found that the participants generalized their picture cue usage to two additional assembly tasks.

While picture prompts have been effective for prompting independent responding, others have turned to technology using auditory prompting devices to support individuals in employment settings. For example, Taber, Alberto, and Frederick (1998) used a self-operated auditory prompting device to teach 5 students with moderate disabilities to independently transition from completed vocational tasks to other vocational tasks. They compared single- and multiple-word recordings, and although there were no differences between the two types of recordings, both types of auditory prompts resulted in a significant increase in the number of independent task changes made by participants. In addition, the results generalized to other settings without additional training.

Recently, many researchers have combined both visual and auditory prompting systems (i.e., photos and auditory cues) delivered on handheld devices to investigate their utility in promoting independent responding among individuals with developmental disabilities in vocational settings (Davies, Stock, & Wehmeyer, 2002a; Lancioni, O'Reilly, Seedhouse, Furniss, & Cuhna, 2000; Riffel et al., 2005). Davies et al. conducted a pilot study to evaluate the effectiveness of a software program called the Visual Assistant (VA), which was loaded on a palm-top computer. The VA presented step-by-step pictures of task sequences along with audio instructions on the computer to prompt responses. Ten individuals with intellectual impairments participated in the study and were taught two vocational tasks that included a pizza box assembly task and a software-packaging task. Participants received training with the VA and were then given a verbal overview of the tasks as well as demonstrations prior to task engagement. They were then asked to perform each task twice, once with the VA and once without. Results indicated improved accuracy and task independence when participants used the VA as opposed to when they did not. Riffel et al. extended the research on the use of the VA by teaching instructors to use the device to assist four students with mild to moderate intellectual disabilities to perform tasks such as table setting, rolling silverware, and laundry tasks. Results indicated that students increased the percentage of steps completed independently while also reducing prompts from instructors when the VA was used. In addition, participants appeared to prefer the device over instructor assistance as they increasingly self-selected the VA to assist them in completing the task rather than requesting assistance from teachers.

Similarly, Lancioni et al. (2000) conducted two studies that also investigated the effectiveness of using a palm-based computer system for teaching vocational tasks to individuals with severe developmental disabilities. In the first experiment, the authors compared the effectiveness of a palm-top computer that presented line drawings (in conjunction with a special auditory device or vibratory mechanism placed under participants' belts) with a card system that was a booklet containing 25-31 pictures of the steps required in the skill sequences. Six adults participated and were taught different sets of tasks that involved cleaning and food preparation. Results indicated that participants not only had higher percentages of correct responding with the computer system, but also preferred it to the card system. Three of the participants who had acquired a high degree of correct responding in the first study also participated in the second study. In the second study, the researchers taught the same tasks as in study one and presented all stimulus materials using the computer-based system, but compared variations of how the pictures were presented (i.e., the stimulus materials were altered somewhat so that the participants would not have to return to the computer as often during task engagement). Results indicated that clustered presentations were more effective in maintaining correct task performance and participants required less prompting, or instructional opportunities, delivered from the device.

In essence, it appears that handheld computers, when used as prompting systems, are effective for promoting correct independent responding among individuals with moderate to severe disabilities. In addition, handheld devices appear to be effective at reducing external prompting from staff during task engagement and have also been used to encourage time management and scheduling among individuals with mental retardation (Davies, Stock, & Wehmeyer, 2002b) as well as initiation and completion of daily tasks among individuals with ADHD (Epstein, Willis, Conners, & Johnson, 2001). Handhelds are also desirable because they are portable, relatively inexpensive, and used frequently among individuals without disabilities, which makes their use socially acceptable. Although handheld devices appear to be useful for instructing individuals with disabilities, research to date has focused primarily on the presentation of photos, auditory prompts, and cueing systems (vibration or alarms) with these devices. To our knowledge, there has not been any research conducted on the use of video-based materials presented on handheld devices to teach skills to persons with disabilities.

Video technology is emerging as an effective medium for teaching life skills to individuals with developmental disabilities. For example, it has been used to teach complex skills such as purchasing items (Cihak, Alberto, Kessler, Taber-Doughty, & Gama, 2006), vocational tasks (Martin et al., 1992; Morgan & Salzberg, 1992), community skills (Alberto, Cihak, & Gama, 2005; Branham, Collins, Schuster, & Kleinert, 1999), grocery shopping (Ayres & Langone, 2002; Mechling, 2004; Mechling & Gast, 2003), social skills (Goldsworthy, Barab, & Goldsworthy, 2000; Nikopoulos & Keenan, 2004; Simpson, Langone, & Ayres, 2004), and daily living/domestic skills (Bidwell & Rehfeldt, 2004; Graves, Collins, Schuster, & Kleinert, 2005; Lasater & Brady, 1995; Norman, Collins, & Schuster, 2001; Rehfeldt, Dahman, Young, Cherry, & Davis, 2003; Shipley-Benamou, Lutzker, & Taubman, 2002; Sigafoos et al., 2005; Van Laarhoven & Van Laarhoven-Myers, 2006).

Research that has been conducted on the use of video technology within the vocational domain has had mixed results. For example, Morgan and Salzberg (1992) used video-assisted instruction to teach employment-related problem-solving skills to adults with disabilities. They showed participants videos of positive and negative examples and asked a series of questions to provide discrimination training prior to assessing participants in actual work settings. Results indicated that effects did not generalize until behavioral rehearsal was introduced for 2 of the 3 participants. Martin, Mithaug, & Burger (1992) compared several different instructional strategies for teaching assembly skills to secondary students with moderate disabilities in an unused classroom. These strategies included: (a) photographs (a photo of completed piece of furniture); (b) sequenced pictures (comprised of line drawings); (c) sequenced pictures plus modeling (same as previous, only the experimenters also modeled how to perform assembly); (d) picture referencing (used in conjuction with sequenced pictures, the experimenter also pointed back to picture when student made an error or no response); (e) video modeling (participant was shown video clip of step prior to performing step; also called video prompting); and (f) video referencing (used in conjunction with previous, only video clip was played again following errors or no response; also called video feedback) The researchers found picture referencing to be more effective than video modeling and video referencing. However, video referencing (e.g., video feedback) was almost as effective as picture referencing, and video modeling became more robust as students had exposure to it.

To our knowledge, there has not been any research done investigating the utility of using a handheld device to present video-based materials to promote independent responding among individuals with mild to moderate disabilities. The purpose of this research was to determine if video modeling and video feedback, when presented on a portable handheld device, would increase independent responding of two individuals who were employed in community-based environments. The current study extends available research in a couple of ways. First, this study differs from the others in that it evaluated the effectiveness of using video-based instructional materials presented on a handheld device, whereas prior research using this technology evaluated the effectiveness of using picture-based materials. Second, a feedback component was also used to provide error correction. And third, the research was conducted in community-based settings with non-disabled coworkers.

For the purposes of this paper, the video modeling/rehearsal component will be referred to as video rehearsal and will refer to the entire video sequence being presented prior to task engagement. The video feedback component will refer to having the participant view a video clip (displaying correct performance) following errors that occurred during task engagement.

The instructional methods that were compared are built on existing research that demonstrates the success of video modeling and video feedback while employing the latest technology and theory of computer-assisted instruction.

Method

Participant Selection

Participants were recruited from high school programs located in the suburbs of Chicago. To recruit, a description of the study was e-mailed to teachers in several school districts. Of those who responded, a follow-up questionnaire was sent to:(a) identify students who were in the process of obtaining new jobs in community environments, (b) obtain personal information for the participant to obtain informed consent and assent, and (c) obtain information regarding potential job sites in order to request permission from the employers to conduct research in their establishments. Participants were then selected from the pool of respondents based on the criteria listed above.

Participants

Two young men with mild and moderate cognitive impairments, who attended public school programs, participated in the study. Both were recently hired at two different restaurants in the community and neither had any prior exposure to their assigned tasks.

Devon was an 18-year-old student enrolled in a large suburban high school where his educational goals were met through inclusive programming and practices. His full scale score on the Wechsler Abbreviated Scale of Intelligence (WASI; Psychological Corporation, 1999) was 78 and he had a diagnosis of Asperger's syndrome. Much of his coursework was taught at the basic fundamental level by general education teachers, coupled with the assistance and support of special education teachers and/or special education teaching assistants. He had been enrolled in a basic skill computer class and was fairly adept at utilizing a PC computer for basic word processing, PowerPoint™, internet searches, and email activities. Devon also received speech therapy, occupational therapy and adaptive physical education services. He demonstrated a significant "aversion" to any type of job or employment opportunity and initially refused to participate in any capacity. After one year of career counseling, he agreed to "sampling" job tasks for periods extending no longer than 45 minutes per week. Some of these experiences involved light office duties and some food preparation. With some coaxing, he agreed to increase his work hours to eight hours per week and was hired at Red Robin, a large restaurant chain where the study took place. He seemed very motivated to keep this particular job and engaged in frequent discussions regarding his attitude and what types of dispositions were important for employees to possess. His primary job responsibilities involved sorting and sanitizing silverware and rolling silverware.

Marcus was an 18-year-old student enrolled in an inclusive high school. Most of his instructional programming, however, was conducted in a self-contained, life skills classroom taught by special education teachers. He had Down syndrome and his full scale IQ score on the Wechsler Adult Intelligence Scale – 3rd Edition (WAIS-III; Wechsler, 1997) was 47. Marcus required extensive prompting to complete most tasks and was highly cue dependent. Just before he entered the high school environment, he experienced some type of social/emotional setback and was unable to complete academic and work tasks to the degree that he had previously performed them. He also demonstrated a great drop in receptive and expressive communication, social participation, and moving throughout his environment without direction. Previously, Marcus received instruction accessing PC computers for the purposes of word processing, PowerPoint™, and basic email. He could complete basic tasks with visual and/or verbal prompts. His previous work experience involved light custodial and some office work. He was hired at Applebee's, another large restaurant chain, for nine hours per week and this is where baseline and instructional sessions took place. His primary duties involved portioning food for various recipes and cleaning and sanitizing his workspace.

Setting

Baseline and instructional sessions were conducted in the participants' employment settings; Devon was at Red Robin, and Marcus was at Applebee's. Devon worked primarily in an area off the kitchen at Red Robin and was scheduled to work on Friday and Saturday evenings for four-hour shifts. This area could be described as an open area or large hallway that was near the refrigerator and back exit. Most of his tasks were completed at a tall stainless steel rolling table (e.g., rolling and sorting silverware, and sanitizing the rolling table), however, he also had to go to the front of the restaurant to replace completed silverware rolls and to clock in and out. Other aspects of his job required him to also go to the dishwashing area to sanitize sorted silverware or to obtain trays of rinsed silverware that needed to be sorted. This setting was often quite busy, i.e., loud music was in the background and coworkers were rushing around while engaged in work activities. Staff members were very outgoing and friendly and the managerial employees were very supportive and always encouraged him to be part of the team.

Marcus worked in an area behind the kitchen at Applebee's. He was scheduled to work three mornings a week before they opened for lunch and his primary responsibilities involved portioning food for various recipes and cleaning and sanitizing his work area. Most of his tasks were completed while standing at a tall stainless steel counter. He also had to place trays of portioned food in the walk-in refrigerator, bring empty vegetable bins to the dishwashing area, get ice cubes from an ice machine in the kitchen, and clock in and out at the front of the restaurant. Staff members at Applebee's were very supportive of Marcus. They adapted recipe sheets for him, had an assistant kitchen supervisor assigned to train and assist him, and often set up his station before he arrived.

Tasks

Devon had three tasks that were targeted for instruction. These included: (a) rolling silverware, (b) sorting and sanitizing silverware, and (c) clocking in and out. Marcus also had three tasks targeted for instruction including: (a) portioning recipes (i.e., 4 oz house salads, 8 oz salads, 8 oz stir fry veggies, & 5 oz side veggies); (b) clocking in and out; and (c) cleaning and sanitizing his work space. Task analyses of each task are available from the first author.

Instructional Materials

An HP iPAQ hq2700 series Pocket PC™ (that operated with the Microsoft Pocket PC 2003, 2nd edition software™) was used as the prompting device. Videos were taped in each participants' vocational site and were comprised of a combination of "self" models (the participant performing the task), and "other" models (both male and female adults that were either one of the first two authors or another employee). Videos were edited using Pinnacle Studio 8™ (Pinnacle Systems, 2002) and each task was edited to show the entire sequence from start to finish (e.g., clocking in sequence). Video segments were comprised of a combination of wide angle (full view of the model in context) and zoom shots (showing the hands of the model). A photo of the most salient feature of the sequence (e.g., sliding employee card in computer) was "grabbed" out of the video and placed at the beginning of each video segment and voice over narration was added to highlight critical components of the task. Prior to videotaping each task, task analyses were written to ensure that all of the steps would be represented in the video model. Each step in the task sequence was videotaped and then all of the steps in the sequence were combined together through the use of transition "swipes" to create a step-by-step video of the task. Once the video sequences were edited and rendered, they were then compressed to Windows Media Video (.wmv) file formats using the free download of Easy AVI/VCD/DVD/MPEG Converter™, version 1.1.8 software (8864soft.com, 2005). This was necessary, or the videos would not play on the Pocket PC.

Once the videos were compressed, each sequence was then placed on a presentation slide using Pocket Slides™, version 4.0.100.1190 presentation software (Conduits Technologies, Inc., 2005). This presentation software was used to make it easier for the participants to select the correct video that corresponded with the tasks they were to perform at work. The slides also had text above the pictures to describe the content of the video file (e.g., rolling silverware).

Unfortunately, we were unable to find presentation software that would allow for videos to be embedded within the slideshows. Unlike PowerPoint™, which can embed videos within the presentation, the software for handheld devices at the time the study was conducted did not have the capabilities to do so. In order to view the videos, the software had to open Windows Media Player™, and then that had to be closed to return to the slideshow. Originally, we intended to use video prompting to present clusters of steps (two to three steps) within the skill sequence; however, that would have involved frequent opening and closing of the media player, thereby making it more difficult to use. We felt that it would be easier to use the device for presenting full sequences of the task prior to task engagement (video rehearsal) and also chose to use video rehearsal strategies due to the nature of the tasks that were being performed. The participants needed the use of their hands for most aspects of their tasks.

In addition to the video-based materials, additional visual supports were provided to assist Marcus with using the scale to portion food recipes. These support included small, color-coded Post-It® flags that were placed on the correct number of ounces needed for each recipe on Marcus' scale. The Post-It® flags were added beginning on session seven. This was done to highlight the correct number on the scale and to assist him with lining up the arrow within the acceptable "range" of ounces needed (rather than aligning the arrow exactly on the number on the scale).

Design

A multiple probe design across tasks was used to evaluate the effectiveness of the video-based procedures on independent responding and percentage of prompts and was replicated across students (Gast, Skouge, & Tawney, 1984; Horner & Baer, 1978). Baseline data were collected for all three tasks prior to the introduction of the independent variable on the first task. Once the students met criterion on the first task (i.e., 80% correct independent responding for three consecutive sessions), baseline probes were then conducted on the other two tasks in the second and third tier. Baseline probes were again implemented for the third task once participants met criterion on the second task.

Baseline and Maintenance Procedures

Baseline consisted of observing participants engaging in their assigned tasks without access to the handheld device. Data were collected only on the first attempt for each task (e.g., first attempt at rolling silverware). During initial training, participants were given several demonstrations from their coworkers on how to perform each task in their job description (and videotaping was conducted during this time). Participants were then expected to attempt the tasks themselves and were given assistance from the researchers or job coach and this is when baseline data were collected. During this time, participants were first given an opportunity to attempt the task independently. If there was no attempt within five seconds or an error was made, they were given a verbal prompt, followed by a gestural/physical prompt if the verbal prompt was ineffective for each step in the skill sequence. Maintenance sessions were conducted in the same manner as baseline sessions; however, a demonstration was not provided.

Instructional Procedures

Participants were given the handheld device and shown videos of each instructional sequence prior to engaging in the required task. For example, when they first arrived at work, participants were met at the door by the researchers or job coach and were given the handheld device and shown the clocking in sequence. Participants independently put on headphones, held the device, and were prompted to select and play the correct videos using a system-of-least prompts prompting hierarchy. After viewing the videos, participants gave the handheld back to the job coach and/or researcher, who then carried the device to the location of the next task. When it was time for them to switch to a different job task, participants were prompted to get the handheld and watch the video sequences prior to engaging in the next task. They were only given prompts when necessary.

It should be noted that although Marcus had four different recipes to portion (and a different video for each), they were all very similar in that they involved weighing food and placing it in bags. There were only subtle differences between the steps required to complete each recipe and they varied in terms of the type of food that was weighed, the number of ounces needed, and the types of baggies used. The recipes changed across days depending on the needs of the restaurant and he was often required to portion two or three different recipes within one work session. Each recipe constituted a session and he may have had two or three recipe sessions in one day (on most days, he would portion only one or two recipes). Similarly, Devon needed to shift back and forth between rolling and sorting and sanitizing silverware throughout his shift. Depending on the level of customer volume, he may have had three to four sessions of each of these tasks within one shift. There were also only subtle differences between clocking in and clocking out. Therefore, clocking in constituted one session and clocking out constituted another. Participants were shown videos prior to engagement with each task as they changed during their shifts. After viewing the video, the participants immediately engaged in the task and were given prompts as needed.

Training Participants to Use Technology/Photos

Prior to engaging in instructional sessions, each participant was given instruction on operating the handheld device. One of the researchers met with participants individually and demonstrated how to use the device using a model-lead-test format. A video that was not used in the study (i.e., how to set an alarm clock) was used for instruction on device operation; however, neither participant met criterion (which was set at 80% independent correct responding for three consecutive sessions), and both needed assistance in operating the device throughout the study. Unfortunately, there was very little time to provide instructional sessions on device operation prior to the start of the study. Parent permission slips were returned at the end of the regular school year and students were out of school for a couple of weeks prior to the beginning of the summer session, which is when the study took place. Both participants were hired during the summer session and began work within two days of being hired. As a result, only three 20-min instructional sessions could be scheduled for each participant prior to intervention. Due to the relatively short period of time between their being hired and beginning work, neither participant met criterion on device operation. Marcus needed prompting on how to use the device throughout the study. Devon learned to operate it independently by session 15, but needed assistance if he accidentally selected the incorrect video or if he accidentally opened the wrong application. Although the timing of the study prevented sufficient instruction on device operation, we are confident that both participants could have met criterion had there been more time for instructional sessions.

Error correction. A two-level prompting hierarchy was used during both baseline and instructional phases. In the event of an error or no attempt within 5 seconds of the natural discriminative stimulus, participants were given a verbal prompt to respond. If the verbal prompt was not sufficient to prompt a correct response, a gestural or physical prompt was provided (depending on what was necessary for the particular step) to ensure correct responding. During instructional phases, participants were also shown a positive video model of the skill sequence following every fifth error in that specific skill sequence. For example, when portioning vegetables for the recipe task, if Marcus made an initial error when putting on gloves, and then made an error on the weighing step for the next four bags of vegetables, he was shown the video for that task. In essence, participants were given video feedback once there were five errors within a skill sequence, however, verbal, gestural, or physical prompts were given during the intervening errors; this was done to reduce the number of times the participants needed to stop their work to watch the video. Five errors was arbitrarily selected as a point to provide video feedback and this was decided prior to intervention.

Independent Variables

Video rehearsal. Participants viewed a video-based multimedia sequence on the handheld device prior to engaging in the task.

Video feedback. Participants were shown a video of the skill sequence following every fifth error in the skill sequence. Participants were shown the entire sequence and given positive verbal feedback from the researchers on steps that were performed correctly and constructive feedback on steps that were performed incorrectly. The only exception was that a special feedback video was created for Marcus that showed adding or removing vegetables from the bag on the scale during the recipe sequences. He made several errors on that particular step, and watching the full sequence (including handwashing, putting on gloves, etc.) seemed unnecessary.

Data Collection Procedures

During baseline, instructional, and maintenance phases, task analytic data were collected with correct/incorrect responses and prompt levels being reported on each step of the skill sequence. A '+' was recorded for independent correct responses, a '-' was recorded for incorrect attempts, an 'n' was recorded for no attempt, and a '√' was recorded for each prompt given at each step (with a maximum of two per step). In the event that one of the steps was completed by a coworker, an 'NA' was recorded and that step was not included in the total number of steps during data summarization. Data were recorded on the first attempt of the task immediately following the video rehearsal procedures (e.g., the initial silverware roll). In addition, tic marks were made on the data sheet after the initial attempt of the task to keep track of errors (to know when to provide video feedback).

Dependent Measures

Percentage of independent correct responses. Participants were assessed on how independently they performed the skills selected for instruction prior to engaging in the instructional sequences (baseline), during instruction, and following instruction (maintenance for Marcus). The score was determined by dividing the number of steps with independent responding by the total number of steps in the skill sequence and multiplying by 100. Baseline and maintenance sessions differed from instructional sessions in that participants were expected to perform the skill without viewing videos on the handheld device.

Percentage of prompts. Participants were assessed on the number of external prompts they needed to complete the skill sequence during all phases of the study. The score was determined by dividing the number of prompts given by the total number of prompts possible (i.e., two per step) and multiplying by 100. Video feedback was not included in this total.

Number of sessions to reach criterion. The acquisition criteria for each skill sequence was a score of 80% or higher for three consecutive sessions as measured by percentage of independent correct responding following the introduction of the video-based materials.

Data Analysis

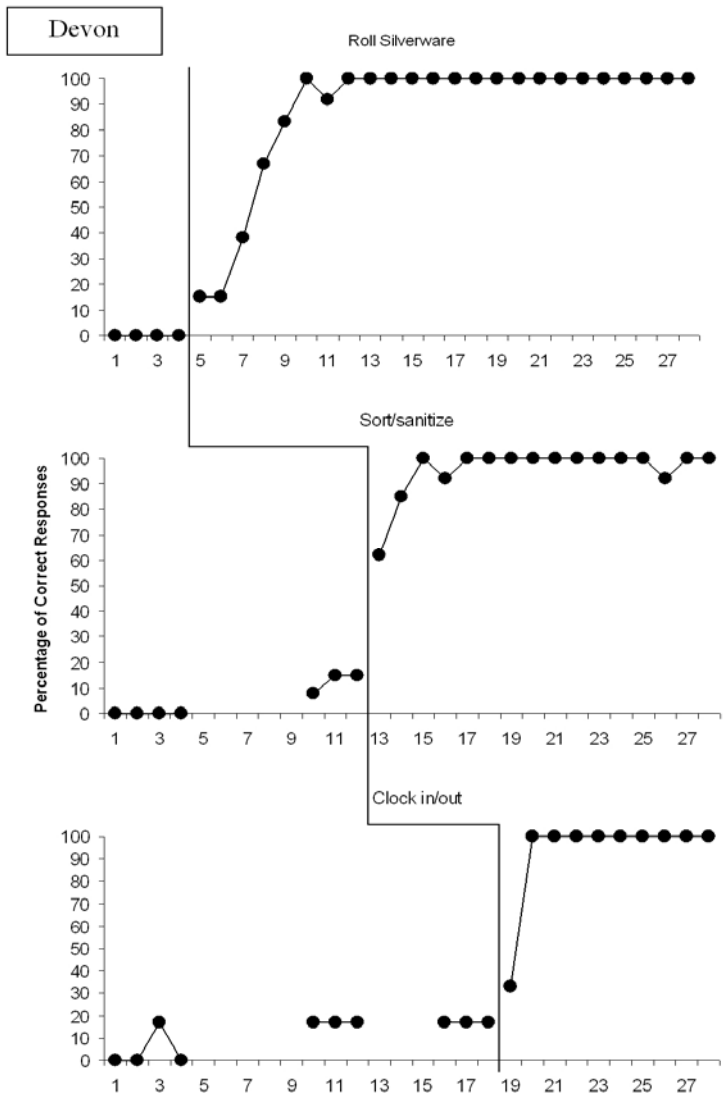
Experimental control was determined primarily through visual inspection of the data and through comparisons of means and trends for each phase and changes in the level of data across phases. With the multiple probe design, experimental control is demonstrated by a consistent change in level and/or trend of the data from baseline phases to intervention phases and lack of changes in the untreated behaviors (Wolery, Bailey, & Sugai, 1988).

Reliability

Reliability sessions were conducted on 27% of all sessions for Devon and 45% of all sessions for Marcus (including baseline and instructional sequences). The percentage agreement index (i.e., number of agreements divided by number of agreements plus disagreements and multiplied by 100) was used to calculate inter-observer agreement. A research protocol was written and shared with all observers regarding methodology and data collection procedures. All observers practiced data collection during practice sessions in the restaurant settings until they achieved scores of 90% agreement or higher for three consecutive sessions.

Agreement for correct responding for Devon across sessions resulted in a mean score of 98% (range = 92-100) and agreement for prompts resulted in a mean score of 95% (range = 85-100). Agreement for correct responding for Marcus across sessions resulted in a mean score of 97% (range = 90-100) and agreement for prompts resulted in a mean score of 95% (range

Figure 1. Percentage of independent correct responses for Devon.



= 86-100). In addition, the second observer collected procedural reliability data (Billingsley, White, & Munson, 1980). These measures included the following: (a) checking to ensure that the correct video was shown for the intended task for each participant, (b) checking to determine if video feedback was delivered following five errors, and (c) checking that the prompting hierarchy was delivered as intended. Reliability was calculated by dividing number of correct measures by total number of assessed variables and multiplying by 100. Procedural reliability agreement averaged 100%.

Results

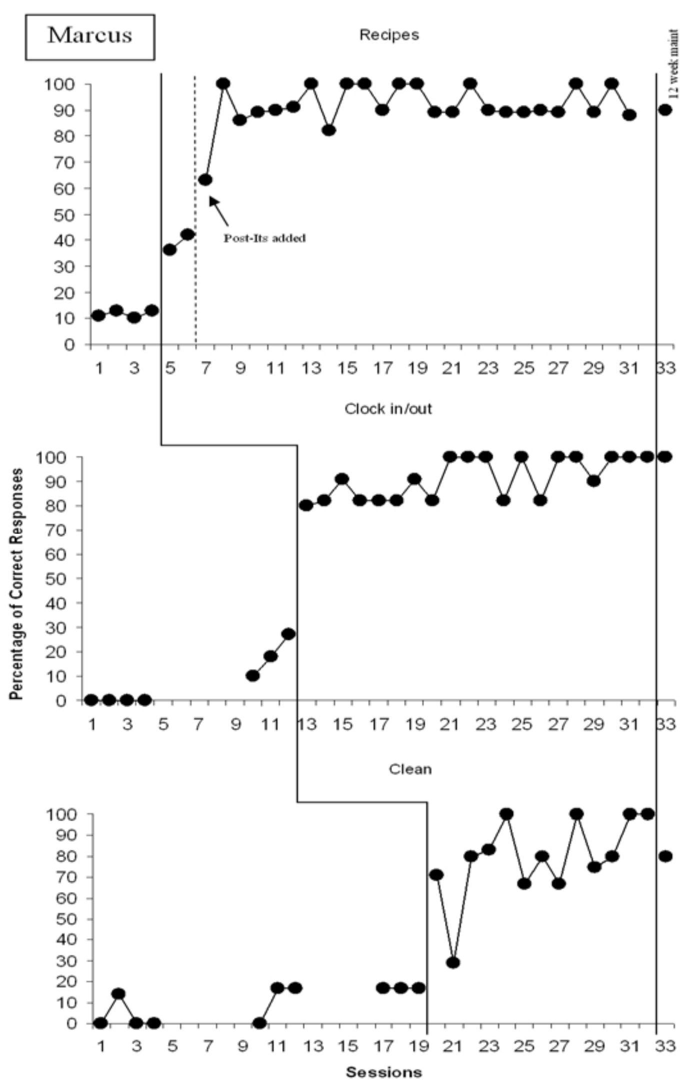
The introduction of the video-based materials appeared to be associated with an increase in independent responding and a reduction in prompting for both participants.

Percentage of Independent Correct Responses

Figure 1 presents data for Devon's independent correct responses. Although the data were ascending slightly in the second and third tier, the introduction of the video-based materials were associated with a marked change in level from baseline to instructional phases with a rapid increase in correct responding following one to three sessions with video instruction. However, there were no dramatic increases with the other tasks during this time, which suggests that the presentation of the videos were responsible for the increase in correct responding. When the means of each phase were compared, there were large differences in the percentage of correct independent responding for each task across baseline and instructional phases. For the rolling silverware task, the baseline mean was 0% as compared to 88% during the instructional phase, while the baseline mean for sorting and sanitizing task was 5% as compared to 96% during the instructional phase. The clocking in/out task also had large increases with the mean baseline being 12% as compared to 93% during the instructional phases. Unfortunately, no maintenance data were collected for Devon because he was laid off for a while and obtained a different job before being hired back at Red Robin.

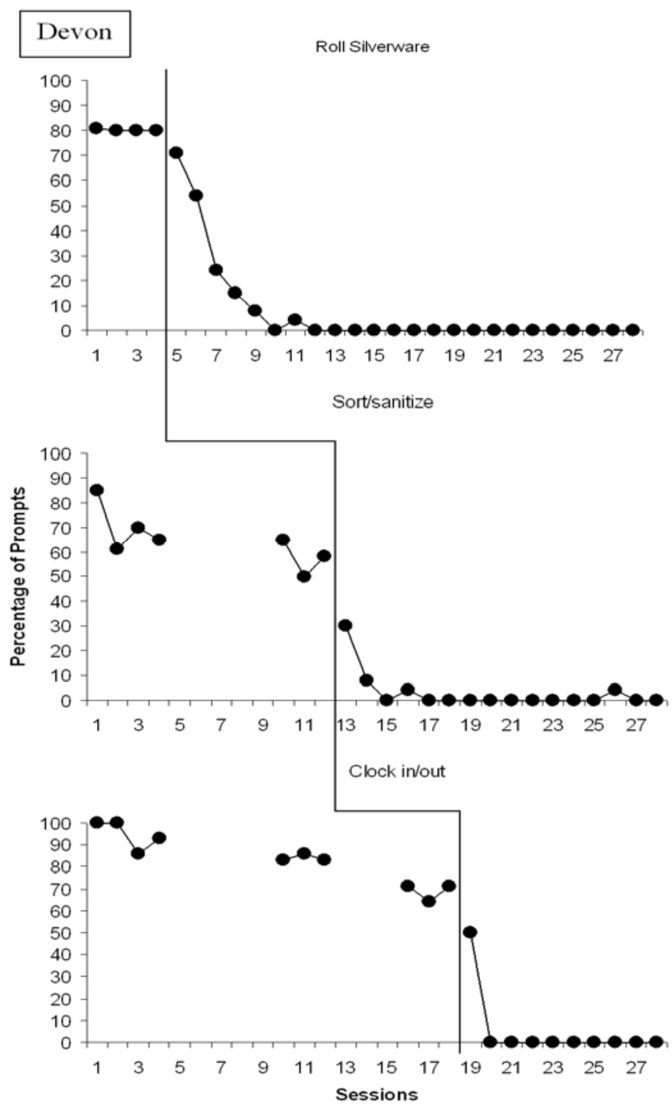
Figure 2 presents a graphic representation of data for Marcus' independent correct responses. Although the data were ascending slightly in the baseline of the second tier, the introduction of the video-based materials were associated with a marked change in the level of data from baseline to intervention. During the instructional phase

Figure 2. Percentage of independent correct responses for Marcus.



for recipes (top tier), Post-It® flags were placed on Marcus' recipe sheet by staff and he was expected to place the flag on the corresponding number on the scale. This support was added beginning with session number 7 because he was having a great deal of difficulty judging if he had "enough" or "not enough" food in his portion bag and was making frequent errors on this step. We felt that it was necessary to highlight the correct number of ounces needed and to give him an acceptable "range" in which to align the arrow of the scale. There were times when he would spend an inordinate amount of time trying to align the arrow with the exact tic mark associated with the number of ounces needed and it was important for him to move quickly. With the Post-It® flags, he needed to have the arrow somewhere within the area covered by the flag. In addition, a feedback video was created that provided specific instructive information for that step. These videos demonstrated that food needed to be added if the arrow was "before" the flag, and that some food needed to be removed if the arrow was "past" the flag. Although the addition of the Post-It® flag and special feedback video reduced subsequent errors on that step, prior to their introduction, there was still an abrupt change in level of data between the

Figure 3. Percentage of prompts for Devon.

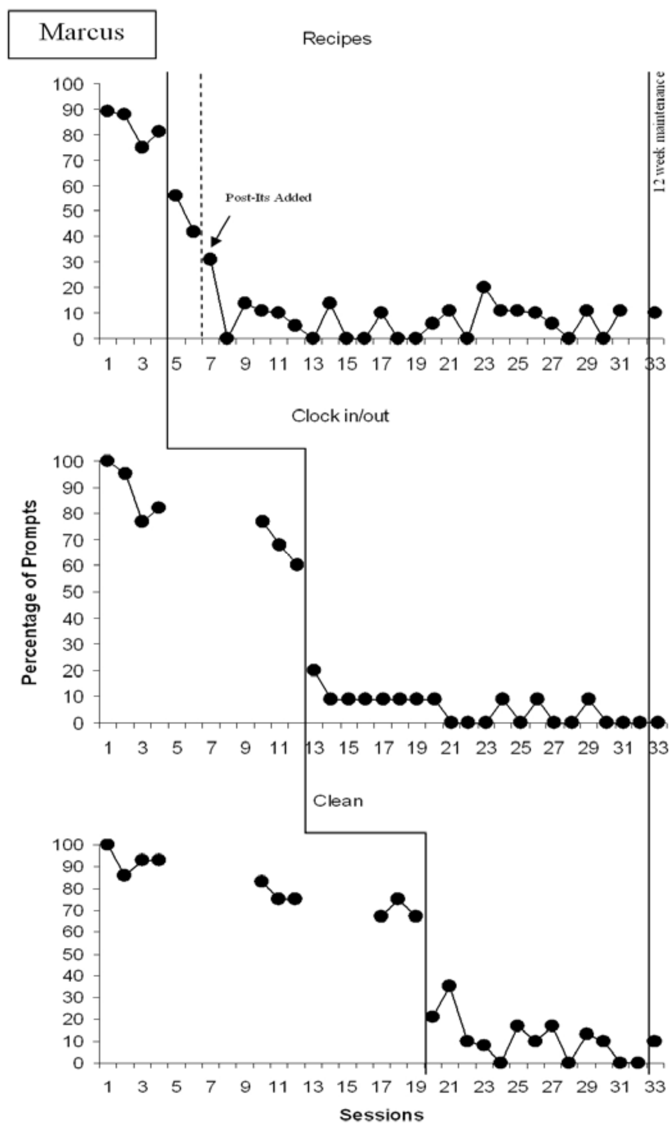


baseline and intervention phase. Also, the addition of these supports only affected one step in the sequence and did not influence the scores significantly, suggesting that the video materials were still responsible for the rapid increase in correct responding. When the means of each phase were compared, there were large differences in the percentage of correct independent responding for each task across baseline and instructional phases. For the recipe task, the baseline mean was 12% as compared to 92% during the instructional phase, while the baseline mean for the clocking in/out task was 8% as compared to 91% during the instructional phase. The cleaning task also had large increases with the mean baseline being 10% as compared to 79% during the instructional phases. In addition, performance was maintained on all three tasks when assessed 12 weeks following intervention.

Percentage of Prompts

When the percentage of prompts were analyzed, there was also a rapid reduction in prompts for both participants once the video-based materials

Figure 4. Percentage of prompts for Marcus.



were presented. Figure 3 presents a graphic representation of Devon's percentage of prompts during baseline and intervention phases. Although the data were descending somewhat in tiers two and three, there were changes in the level of data with each introduction of the independent variable followed by a rapid reduction in prompts by the second or third session with the video-based materials. When the means of each phase were compared, there were large reductions in the percentage of prompts for each task across baseline and instructional phases. For the rolling silverware task, the baseline mean was 80% as compared to 7% during the instructional phase; the mean baseline for sorting and sanitizing task was 65% as compared to 3% during the instructional phase, and the clocking in/out task also had large decreasees with the mean baseline being 84% as compared to 5% during the instructional phases.

Figure 4 presents a graphic display of Marcus' percentage of prompts and like Devon, he also had a drastic decrease in the percentage of prompts needed from baseline to intervention phases. These results are somewhat tempered by the fact that the data are gradually decreasing in each baseline prior to the introduction of the independent variable; he was obviously relying less on staff to perform the skills (i.e., he needed fewer gestural/physical prompts to complete some of the steps). However, there were abrupt changes in the level of the data for all three tasks when the video-based materials were introduced, which provides evidence that their introduction was responsible for the reduction in prompts needed to perform the skills. When the means of each phase were compared, there were large reductions in the percentage of prompts for each task across baseline and instructional phases. For the recipe task, the baseline mean was 83% as compared to 11% during the instructional phase; the mean baseline for the clocking in/out task was 80% as compared to 6% during the instructional phase, and the cleaning task also had large reductions with the mean baseline being 81% as compared to 11% during the instructional phases. Prompts were further reduced when assessed during the 12-wk maintenance probe.

Sessions to Criterion as Measured by Independent Correct Responding

In order to meet criterion, participants had to score at least 80% or higher as measured by independent correct responding for each task. Both participants required an average of five sessions to reach criterion with the tasks once the handheld devices were introduced, which suggests that the video rehearsal and feedback were very powerful instructional techniques.

Outcomes and Benefits

The purpose of this research was to determine if video modeling and video feedback, when presented on a portable handheld device, would increase independent responding of two individuals who were employed in community-based environments. Results of this investigation indicate that the introduction of the video-based materials was associated with an increase in independent responding and a reduction in prompting for both participants. In addition, both participants met criterion with each of their three tasks very quickly once the handheld was introduced, suggesting that this was a very powerful instructional tool. In terms of social validation, both participants informally indicated that they liked using the handheld and Devon stated that he would like to participate in future studies and both participants indicated that they liked watching videos. The employers and other coworkers also communicated that they believed the handheld device was a very beneficial tool.

Although the intervention appeared to be effective, there are several limitations to this study. First, prior to the introduction of the video-based materials, some of the baselines were slightly ascending which would indicate that the participants were learning to perform the skills with prompting alone. However, once the intervention was applied to each task, there was a marked change in the level of data from baseline to instructional phases followed by a rapid increase in correct independent responding and a decrease in percentage of prompts required for each participant across all tasks. This change in level followed by rapid changes in behavior only in the instructional phases suggests that the application of the independent variable was responsible for those changes and experimental control was established. Second, because there was no component analysis conducted, it is difficult to determine if the video rehearsal or video feedback conditions were responsible for changes in behavior, or if the combination of the two were responsible for the change in student responding. Future research should be done to compare the effectiveness of the two procedures to determine if they are equally as effective when presented in isolation. Third, although the video-based instructional sequences increased independent responding across tasks, they were used in conjunction with a prompting system (i.e., verbal and gestural/physical prompts). As a result of using this combination, it cannot be stated that the video procedures alone were responsible for the changes in student responding. However, prior to the introduction of the video-based materials, neither of the participants acquired the targeted skills when taught with prompting alone. Therefore, it seems likely that the video-based materials did have an impact on how quickly participants acquired the skills. And finally, both participants needed assistance operating the technology which ultimately made them dependent on staff.

Unfortunately, there was insufficient training time with the device due to the brief period of time between the participants being hired and their first day of employment. Devon was eventually able to operate the device by the 15th session, but still required assistance if an error was made in application selection or if he selected the incorrect video for the task. Marcus had a great deal of difficulty operating the device and needed assistance throughout the entire study (primarily with selecting the correct application and the correct video). Lack of training time and limited exposure to the use of handhelds contributed to these difficulties, but we believe that the complexity of the navigation system was what ultimately prevented the participants from operating the device independently. Prior to initiating this study, we attempted to address this issue by investigating various software applications for handheld devices to see if there was presentation software that had the capability to embed video files within slideshows to make the navigation easier for the participants. Unfortunately, software that is available for handheld devices is still somewhat limited in terms of its compatibility and functionality in operating video files. As a result, participants were required to view video files in Windows Media Player™ and then had to close the player to return to the slide show, making the navigation somewhat more difficult. However, we are confident that with advances in technology, handheld devices will eventually function as effectively as laptop or desktop computers and that software will continue to improve, making independent operation of the devices more likely among individuals with intellectual impairments. Although the navigation systems may need to be simplified in order to promote independent use of handheld devices, presenting video-based materials within the employment setting appeared to be very effective.

In particular, we believe that the video rehearsal and feedback strategies were very beneficial for focusing the participants' attention on a model immediately prior to task engagement and following errors, especially when the tasks changed frequently within one work session. Because this study was conducted in a competitive employment setting, participants were required to perform tasks that changed based on the immediate needs of the employment setting. For example, Marcus had a difficult time remembering the subtle differences between the recipes and would make frequent errors as soon as he switched to the new recipe. His errors decreased considerably after he was given the opportunity to view the videos prior to switching the the new recipes and following feedback trials, which ultimately led to an increase in independent responding.

One of the reasons we believe the videos were so effective is because the participants were able to focus their attention on the relevant features of the task in a very controlled manner. By focusing their attention on the handheld screen and listening to the narration through headphones, we were able to reduce the distractions that were abundant in the employment settings (e.g., loud music, coworkers). In addition, we believe that the way the videos were created also assisted with focusing the participants' attention on the critical dimensions of the tasks. For example, when creating the videos, we zoomed in on the salient features of the task (e.g, the arrow on the scale) to ensure that the students were attending to the correct and relevant stimuli. In doing so, we were able to focus the participants' attention on the correct model while also reducing the distracting stimuli in the environment. Using zoom shots were also important due to the fact that the handheld devices have smaller screens. It was important to make the videos as large as possible so that the participants could see the modeled tasks clearly. Widescreen shots were only used when the tasks required the learner to move from one location to another and when it was important for them to pay attention to the environmental cues (e.g., carrying the sorted silverware to the dishwashing station). In addition, we also made the videos as short as possible to maintain the participants' attention and to reduce the amount of time spent using the handheld device.

Even though technology was beneficial, the value of natural supports in the environment are also critical. Perhaps using a combination of natural supports as well as technology-enhanced prompting is the answer. In several work environments, it is quite natural for employees to work cooperatively with coworkers. It is in the best interest for workers with disabilities to establish, build, and access naturally occurring supports and relationships within the vocational realm because these supports are already available. Coworkers could conceivably assist in the operation of the devices if necessary. As in most employment settings, minor modifications and/or adaptations to the environment and/or job responsibilities may need to be adjusted.

In conclusion, video rehearsal and video feedback strategies, when delivered on a handheld device, appeared to be effective in promoting independent responding for the individuals who participated in this study. Hopefully, with continued research and advancement in technology, presenting video-based materials on portable devices will become a viable instructional technique.

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