Comparison of the Effects of Continuous Video Modeling, Video Prompting, and Video Modeling on Task Completion by Young Adults with Moderate Intellectual Disability

Linda C. Mechling
University of North Carolina Wilmington

Kevin M. Ayres
The University of Georgia

Kathryn J. Bryant and Ashley L. Foster
University of North Carolina Wilmington

Abstract: This study compared the effects of three procedures (video prompting: VP, video modeling: VM, and continuous video modeling: CVM) on task completion by three high school students with moderate intellectual disability. The comparison was made across three sets of fundamentally different tasks (putting away household items in clusters of two items; multi-step cleaning tasks whereby each step in the task was completed one time; and multi-component folding tasks whereby steps were performed repetitively). The study combined a multiple probe across behaviors design with an adapted alternating treatments design replicated across three participants. Overall, VP was more effective across the three students for 6 of the 9 tasks, followed by CVM (2 of 9 tasks), and VM (1 of 9 tasks). These data further suggest that the type of task and student characteristics may influence the effectiveness of the three video procedures.

The use of video-based technology to instruct and prompt students with varying disabilities is gaining momentum across both applied settings and the research arena as demonstrated by a number of research applications and literature reviews (Banda, Dogoe, & Matuszny, 2011; Bellini & Akullian, 2007; Delano, 2007; Shukla-Mehta, Miller, & Callahan, 2010). The research base is generally favorable in terms of positive effects of using differing forms of video-based interventions (VBI: Rayner, Denholm, & Sigafoos, 2009) with students with disabilities including those with moderate intellectual disability (MOID) and autism spectrum disorders (ASD). Video modeling (VM) is one form of VBI and involves recording someone other than the user performing a target behavior (Mechling & O’Brien, 2010), while a second form, video self-modeling (VSM), records the user performing the target skill on the video recording (Mechling & Hunnicut, 2011). With each of these forms of VBI, the video is viewed by the user in its entirety followed by performance of the target skill immediately or in a delayed fashion (Taber-Doughty, Patton, & Brennan, 2008). Of the various forms of VBI, VM has received a considerable amount of research attention (Mason, Ganz, Parker, Burke, & Camargo, 2012) in support of increasing a range of functional, daily living skills including: putting away groceries (Ayres & Langone, 2007); making a sandwich (Rehfeldt, Dahman, Young, Cherry, & Davis, 2003); and cleaning a sink (Van Laarhoven, Zurita, Johnson, Grider, & Grider, 2009).

A third form of VBI, video prompting (VP), is created with either the user or someone else performing the target task, however the timing of the viewing and performance of the skill differs from traditional video modeling.
The video, when using VP, is made by breaking the task into steps and recording each step separately. The user watches a step, performs the step, and then views and performs a subsequent step, and so on until the task is completed (Mechling & Gustafson, 2009; Mechling & Stephens, 2009; Van Laarhoven, Kraus, Karpman, Nizzi, & Valentino, 2010).

Like VM, VP has also received a considerable amount of research attention (Banda et. al., 2011) in support of increasing a range of functional, daily living skills including: setting a table (Goodson, Sigafoos, O’Reilly, Cannella, & Lancioni, 2007); cooking (Graves, Collins, Schuster, & Kleinert, 2005; Mechling, Gast, & Seid, 2009); and laundry (Horn et al., 2008).

A less frequently examined form of VBI is termed continuous video modeling (CVM). With this approach the video model continues to play over and over (looping) as many times as needed for the user to obtain information for completing a task (Mechling, Ayres, Purrazzella, & Purrazzella, 2012; Mechling, Ayres, Bryant, & Foster, 2014). The procedure is similar to simultaneous video modeling (SVM) in which the user performs steps in sync with viewing of the video model (Blum-Dimaya, Reeve, Reeve, & Hoch, 2010; Sancho, Sidener, Reeve, & Sidener, 2010; Taber-Doughty et al., 2008), however, the user is not required to complete the task in sync with one repetition of the video.

With this growing body of research it is surprising that relatively little has been done comparing the timing of the response prompt provided by the video, in order to make recommendations concerning the appropriateness of these diverse practices for delivering video across distinct tasks. Both VM and CVM provide a “hands free” means to watch video and complete tasks without step-by-step interaction with a computer or mobile device. This may be important when tasks require fluent movement (e.g., turning on water at a sink, wetting the sponge, and turning off the water) that would be impeded if the user had to stop and start the video. Hands free operation of videos may also be important when the user needs to move freely around a room such as when vacuuming a carpet. Although VM and CVM may assist with the flow of task completion, timing with VM is provided prior to task completion which may not be effective when completing a lengthy or complex task whereby the user cannot remember the steps previously shown on the VM. For this reason tasks are typically shorter in duration when using VM. CVM may be used for lengthier tasks requiring hands free operation without requiring memorization of steps previously seen in the video or when completing tasks requiring multiple repetitions of the same task (e.g., folding clothes), however users may tend to lose their place when trying to follow the video. Attention to pacing of the video model when using CVM is important. Preparation of CVM may require deliberate video recording at a slower pace, with built in pauses, in order for users to follow the video model and provision of this pacing may need to vary across users.

Timing with video prompting is provided in a start/stop fashion immediately prior to completion of each step of the task. This procedure may be useful when tasks have numerous steps or users may have difficulty following the pace of CVM. One of the main disadvantages of VP is that the constant starting and stopping of the video slows down the fluent completion of a task (e.g., wiping off a counter) and the procedure requires a portable device if the user is moving around an area.

The current study sought to extend the limited research by comparing the timing issues previously identified with different forms of VBI. Only four studies were identified which directly compared variations in the timing of the video when working with students with moderate to severe intellectual disability or those with ASD (Cannella-Malone et al., 2006, 2010; Sancho et al., 2010; Taber-Doughty et al., 2008).

Overall, Cannella-Malone et al. (2006, 2010) found VP to be more effective than VM for teaching daily living skills to six adults with developmental disabilities (2006) and seven students (ages 5 to 21 years) with severe intellectual disability (2010). Results of the Sancho et al. (2010) study were supportive of both VM and SVM and Taber-Doughty et al. (2008) found both SVM and VM to be effective with greater independent performance occurring when students used their preferred system.

Ultimately, efficacy of any single format may be heavily dependent on individual user or task characteristics. The current study com-
pared the timing of different forms of VBI (VM, VP, CVM) and did so across three sets of tasks that had fundamental differences in task requirements which have previously been researched using video technology. Set 1 (multi-cluster tasks) involved putting away household items in clusters of two items being put away within each step (Ayres & Langone, 2007) while Set 2 involved multi-step tasks whereby each step in the task was completed one time (Mechling, Ayres, Bryant, et al., 2014), and Set 3 included multi-component tasks whereby steps were performed repetitively (i.e., folding different sizes of towels: Mechling, Ayres, Purrussella, et al., 2012). These different formats of tasks were selected because they represented slight variations in response patterns influenced by task repetitions (e.g., repeated steps in clusters, steps that are never repeated, and steps that are repeated continuously).

Method

Participants

Three high school students (one male and two females) each with a moderate intellectual disability were participants in the study (Table 1). All three received special education services in segregated classrooms for students with disabilities. All three students participated in a previous study evaluating CVM to teach multi-step tasks (Mechling, Ayres, Bryant, et al., 2014). Students were selected for the current study because of their needs to improve their daily living skills and to increase their ability to use self-prompting to complete tasks. They also demonstrated vision and hearing acuities necessary for using VBI and attention to task for up to 20 minutes.

Setting

The study was conducted in the home living center of the high school. The center contained a fully equipped kitchen with stove, refrigerator, microwave, stacked washer/dryer, coffee maker, kitchen cabinets, sink, and kitchen counter tops. There was a large banquet sized table with chairs and two additional metal cabinets for storage. Instructional sessions were conducted individually with each participant across all sets of tasks and conditions.

Tasks, Materials, and General Procedure

Three sets of tasks were selected for the study which focused on teaching functional home living skills. Each set included three different tasks so that each student received instruction within each of the three sets using each video procedure (VM, VP, CVM) with a different task (Table 1).

Each task was videotaped using a Sony camcorder. Video recordings were made of an adult model completing the steps (subjective point of view) of the task analysis. For all video recordings the camera was positioned behind and above the adult model in order to view steps (i.e., cleaning inside of the sink). Voice over directions were provided by the camera operator for each step (e.g., “Squeeze the sponge”). For VM and CVM only one video clip was used to represent the entire task. For CVM, a 3 s delay was inserted before perfor-

TABLE 1

| Student Characteristics and Treatments across Tasks |
|-----------------------------------|-----------------|-----------------|-----------------|
| Age | Diagnosis | IQ | Adaptive Behavior |
| Macon | Elise | Erin | Macon | Elise | Erin |
| 15yrs 10m | MOID | 48 | 55 |
| 16yrs | MOID | 44 | 0 |
| 17yrs 5m | Prader Down Syndrome | 40 | 38 |
| Set 1: Multi-Cluster Putting Away Items | | | |
| Groceries | CVM | VP | VM |
| Office Supplies | VM | CVM | VP |
| Dishes | VP | VM | CVM |
| Set 2: Multi-Step Cleaning Tasks | | | |
| Microwave | CVM | VP | VM |
| Sink | VP | VM | CVM |
| Refrigerator | VM | CVM | VP |
| Set 3: Multi-Component Folding Tasks | | | |
| Shirts | CVM | VM | VP |
| Pants | VM | VP | CVM |
| Towels | VP | CVM | VM |
formance of the next step in the video for the putting away items and cleaning tasks. This was done in order to slow the pace of the video for students who chose to complete steps in sync with the video and needed to physically move around the area and return to the laptop to view the next step. The delay was not used when making CVM multi-component folding tasks in order to provide the natural motor sequence between shorter steps. When using VP, separate video clips were made of each step of the task (or cluster of steps) for putting away items and multi-cleaning tasks. For the multi-component folding tasks, CVM and VM videos were made to show two repetitions for folding each size or type of item for a total of six demonstrations of folding per video (i.e., folding two wash cloths, followed by folding two hand towels). For the VP folding tasks, only one repetition was recorded for each size of item (i.e., one wash cloth).

A Dell Latitude laptop computer was used to play the videos used across each procedure. Videos for each procedure were inserted onto PowerPoint slides. For VM tasks the video was played one time and then stopped. For CVM tasks the feature “loop continuously until esc” was used so that the video continued to play until the task was complete. When using VP, separate video recordings were inserted onto separate PowerPoint slides. A large forward arrow was placed at the bottom right of each slide which advanced the program to the next slide when activated by the computer mouse. The student could also click the mouse on the video to replay the video clip of the current step. For VP PowerPoint, multi-component folding tasks, a picture of the three sizes of items was inserted on the first slide and each size was linked to a separate slide containing the corresponding video. Students or the instructor used the computer mouse pad to “click” on the item selected by the student to be folded next, the video played, and stopped.

Dependent Measure and Data Collection

Correct performance on each step of the task analyses shown in Table 1 was recorded by the instructor across all conditions on a session-by-session basis. A correct response was recorded if a step was initiated with 3 s of completion of the previous step and completed within 30 s following initiation (baseline and VM). For VP the step was recorded as correct if initiated within 3 s and completed within 30 s of the video step. For CVM students could complete a step in sync with the step being performed on the video model or by waiting for the video to loop around to the step if they failed to complete the step in sync with the video during the first play. If the student waited for the video to loop back around, the initiation and duration period began at the end of the video model of the corresponding step (Mechling, Ayres, Bryant, et al., 2014). For the first step of a task, the step was recorded correct if initiated within 3 s and performed within 30 s of the task direction (baseline) or completion of the entire video (VM intervention), completion of the first video step (VP intervention), or at the end of the video model of the video step or loop of the step (CVM). When putting away items, the sequence of steps was not critical as long as the student placed the items in the correct location, however steps in the folding tasks and cleaning tasks were required to be performed in the pre-determined sequence to be recorded as correct. In addition, when folding pants and shirts the item of clothing was required to be placed in the same orientation on the table as in the video (top of shirt and waistbands closer to the student and edge of table). Data were collected during one-to-one sessions three mornings per week and 1–2 tasks were completed per student per session depending on the length of the task (folding tasks took longer to complete).

Experimental Design

The study combined a multiple probe across behaviors design (Gast & Ledford, 2010) with an adapted alternating treatments design (Wolery, Gast, & Hammond, 2010) replicated across three participants. The multiple probe design was used to demonstrate a functional relationship between VBI (VM, VP, CVM) and task performance of students with moderate intellectual disability while the adapted alternating treatments design allowed comparison of the effectiveness of VM, VP and CVM. The dependent variable was the percent of steps completed independently across the three sets of tasks. Each set of tasks was fundamentally
different in order to evaluate differences across types of tasks. The three treatments were applied to different, functionally independent tasks, equated for response difficulty (Wolery et al.) within each set (Table 1). Response difficulty was determined by the number of steps per task and by matching tasks which had similar response topographies and motor requirements (i.e., three folding tasks). VM, VP and CVM were counterbalanced across tasks and students to control for any variation in task difficulty (Table 1) and task presentation within and across sessions was counterbalanced to control for sequence effect. Only one task was completed per session.

Experimental conditions included a baseline, comparison, and best treatment phase across each set. The Baseline condition served to evaluate student performance on each task prior to the comparison of VBI techniques and continued for a minimum of three sessions or until data stabilized across the three interventions with no improvement. The Comparison phase continued until behaviors of one intervention reached criterion level (Wolery et al., 2010). Criterion was defined as completing 100% of the steps correctly within a task for one session. If one behavior reached criterion-level responding before the others, sessions continued for 1.5 times the number of sessions it took the first procedure to reach criterion with a minimum of eight sessions if no improvement in level of performance occurred across each of the three tasks.

The Best Treatment condition served to evaluate the superior treatment (identified during the Comparison condition) in absence of the alternating treatments which could pose a multi-treatment threat (Wolery et al., 2010). Superior treatment was defined by the intervention which reached criteria within the least amount of sessions and showed a more therapeutic data path. In cases where no intervention reached criterion levels after the maximum number of eight sessions, superior was defined as the procedure which showed a more therapeutic data pattern than the others (Wolery, et al.).

**Procedure**

**Baseline procedures.** During baseline sessions students were individually brought to the home living center and stood at the kitchen counter for the multi-step cleaning tasks or the banquet table for the putting away and folding tasks. Materials and the laptop were arranged on the table or counter prior to students’ arrival in the room. A general task direction was provided (i.e., “Show me how you fold towels”) and the instructor waited 3 s for the student to initiate the first step of the task analysis. The student was provided 30 s to complete the step and all subsequent steps and 3 s to initiate remaining steps following completion of a prior step. If the student failed to initiate or complete a step correctly, and the step was critical to the performance of subsequent steps (i.e., obtaining a sponge to clean the sink) the instructor blocked the student’s view and completed the step as unobtrusively as possible (multiple opportunity probe). Incorrect initiation or completion of non-critical steps was ignored and students proceeded to the next step. No prompts were provided by the instructor for incorrect responses and video was not present during baseline sessions. Students received verbal praise for correct responses and attention to the task on a variable rate of reinforcement.

At the end of each session, Erin and Macon received a choice of snack and Elise received tokens (checks) and earned her choice of school supplies (i.e., sticky notes, note pads) after 8 checks were acquired. Only one task was completed each day.

**Comparison procedures.** Procedures were identical to those used during baseline sessions with the exception of providing VBI. For VM sessions the student first sat and watched the entire video sequence before initiation of the first step of the task. The instructor told the student that he/she was going to “Watch all of the video before you start (folding the pants)”. The instructor started the video by clicking the mouse and the video automatically stopped at the completion of one rotation of the video.

For VP sessions the instructor started the first slide which played the first video step. When the video clip ended, the program remained on the slide until the student com-
pleted the step. During all subsequent steps the student clicked the mouse on the arrow to advance the program to the next slide and the video step played automatically. Using the mouse pad students could also click on the still video caption to replay a video if needed before advancing to the next slide. For the VP multi-component folding tasks, clicking the mouse on the arrow returned the program to the picture slide of the three sizes of items in order for students to select the video corresponding to the next size of item to be folded.

For CVM sessions the instructor told the student that he/she was going to, “(Clean the refrigerator) while the video keeps playing.” The instructor started the video by clicking the mouse and the video played continuously until the student completed the task.

Requirements for initiation and step completion were identical to those used during baseline except that for VP the initiation and duration times started with the end of the video clip and for CVM the initiation and duration times started when the video demonstrated the step on the first play or subsequent loops. Reinforcement during VM, VP, and CVM sessions was delivered identically to the procedures used during the Baseline condition.

Best treatment procedures. The superior video procedure, identified for each student during the Comparison condition for each set of tasks, was applied to all three tasks within a set during the Best Treatment condition. Superior treatment was defined by the intervention which first reached criteria and showed a more therapeutic data path. When no intervention reached criterion levels after the maximum number of eight sessions, the procedure which showed a more therapeutic data pattern was considered superior (Wolery et al., 2010). Following this determination, the superior video treatment was applied to all tasks within the set for three sessions. Procedures were identical to those used during the Comparison condition depending on which of the three video interventions was applied to the three tasks.

Social Validity

During the final session of the Best Treatment condition students were shown a box of pasta and asked if they were going to learn to cook pasta with the computer and video, “Would you like to watch the video first and then make the pasta, use the arrows on the computer step by step, or keep the video playing while you cook the pasta?” Macon responded that he wanted to “keep watching it” (CVM), Erin responded that she wanted to use “the arrow” (VP) and Elise also wanted the video to keep playing (CVM).

Interobserver Agreement and Treatment Fidelity

One of two independent observers simultaneously collected data on the dependent variable and procedural integrity across 36.5% of baseline probes, comparison, and best treatment conditions (baseline: 30.6%, comparison: 38.7%, best treatment: 39.5%) and for 35% of Macon’s sessions, 38.9% of Elise’s sessions, 35.7% for Erin’s sessions). Interobserver agreement between the instructor and the independent observers on the steps performed correctly was calculated session-by-session using the formula: agreements divided by agreements plus disagreements and multiplying by 100. The resulting percentage across all conditions, tasks, and students was 98.9% agreement. Across tasks IOA was: putting away items 93.4% (range 82.8%–100%); multi-step cleaning tasks 100%; multi-component folding tasks 99.1% (range 88.8%–100%).

Data for procedural integrity were collected on whether the instructor followed all procedural steps correctly and was calculated by dividing the number of procedural steps completed correctly by the total number of procedural steps to be followed and multiplying by 100. Procedural steps were: (a) providing general task directions; (b) placing all materials in their correct positions on the table, counters, drawers, etc.; (c) starting and stopping the videos for each procedure; (d) provision of reinforcement; (e) providing no prompts or cues; and (f) providing 3 seconds to initiate a step and 30 seconds to complete each step. Overall agreement was 99.8%. The majority of the procedural errors occurred when placing materials in their correct position during the putting away of items task and when the video skipped ahead or did not start automatically,
and the computer ran out of battery charge during one session. In addition, although the instructor performed steps correctly, the school experienced a “lock down situation” on three different occasions.

Results

Figures 1–3 show the percentage of steps completed correctly by each student across the three tasks within each of the three sets. Using
the multiple probe design, introduction of the three video based interventions (i.e. the Comparison phase) was staggered across each set of tasks. Overall, VP was more effective across 6 of the 9 tasks, followed by CVM (2 of 9 tasks), and VM (1 of 9 tasks).

Figure 2. Percentage of steps performed independently correct by Elise during Baseline, Comparison, and Best Treatment conditions across the three sets of tasks using video prompting (closed circles), video modeling (open squares), and continuous video modeling (open triangles). During Best Treatment, only the superior treatment was applied to all tasks.

Set 1: Multi-Cluster Tasks

Prior to intervention with the three video procedures, students completed a minimal number of steps across the multi-cluster tasks. For putting away the kitchen items, students were
unfamiliar with the location of most items; however Erin put everything in the refrigerator during the Baseline condition and therefore completed seven steps correctly. Likewise, Elise knew where to place the pots and pans, but put everything else above the microwave (completing six steps correctly for the grocery task) and Macon put all kitchen and grocery items in the same cabinet. Results were more favorable for VP for 2 of the 3 students when completing multi-cluster tasks (putting away household items in clusters of two items being put away within each step). Erin demonstrated some overlapping

Figure 3. Percentage of steps performed independently correct by Erin during Baseline, Comparison, and Best Treatment conditions across the three sets of tasks using video prompting (closed circles), video modeling (open squares), and continuous video modeling (open triangles). During Best Treatment, only the superior treatment was applied to all tasks.
performance between VP and VM, but the percent of non-overlapping data (PND) between the two interventions was 87.5. Elise demonstrated some overlapping data between VP and CVM, however the PND was again 87.5. Macon completed more steps of multi-cluster tasks when using CVM and experienced one overlapping data point between CVM and VP.

Set 2: Multi-Step Tasks

Prior to intervention with the multi-step tasks (each step completed one time within a task: i.e., cleaning the refrigerator), students completed a minimal number of steps. Erin turned on the water and wet the sponge during the microwave cleaning task and put cleaning powder on the front of the sink and rubbed it with the sponge. When completing multi-step tasks all students performed better using VP. However, differences were minimal in performance between VP and CVM for these tasks with a PND of only 20%. For the multi-step cleaning tasks each student effectively used both VP and CVM. Macon and Erin reached 100% correct performance on the first session when using VP and on the second session with CVM. Elise reached criterion levels with both VP and CVM on the second session and performed 95.8% of the steps correctly when using VP and 53.8% of the steps correctly when using CVM on the first session.

Set 3: Multi-Component Tasks

When performing multi-cluster tasks (steps performed repetitively: i.e., folding pants), the type of task appeared to affect results. Students completed some steps of the folding tasks (i.e., holding the waistband of pants, tops of shirts) prior to video instruction indicating they may have had some prior experience with this common household task. All students performed better when folding towels (as opposed to shirts and pants) regardless of the video procedure. This was the only set of tasks whereby the superior intervention was VM (Erin folding towels) and the only time when Elise performed better when using CVM (folding towels). There was a noticeable amount of overlapping data during completion of the folding tasks by Elise who experienced a 50% PND between the superior intervention (CVM) and VP. PND between the superior intervention (VM) and CVM was 62.5% and 75% between VM and VP for Erin.

Efficiency Data

Data were collected on the percent of errors and number of minutes to complete each task under the three video interventions during the Comparison condition under each video intervention (Table 2). Overall, sessions with VP across the three students and three types of tasks resulted in the least amount of errors. All three students committed fewer errors when using VP for the multi-step cleaning tasks, and two of the three students committed fewer errors when using VP for the multi-cluster putting away items tasks and multi-component folding tasks. Examination of the average time to complete tasks across the three video interventions revealed minimal differences with the exception of Erin’s performance when completing the multi-component folding tasks. She required up to 20 min. (average 16.7 min.) when folding the towels using VM compared to an average of 8 min. (minimum 6 min.) when using CVM to fold the pants. No apparent pattern seemed to appear across the three video interventions in terms of task completion time and better performance time did not occur consistently across interventions.

| TABLE 2 |
| Mean Minutes to Complete Each Task and Percentage of Errors under Each Intervention |

<table>
<thead>
<tr>
<th></th>
<th>Macon</th>
<th>Elise</th>
<th>Erin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minutes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VP</td>
<td>5</td>
<td>10.3</td>
<td>6</td>
</tr>
<tr>
<td>CVM</td>
<td>3.3</td>
<td>5.6</td>
<td>8.3</td>
</tr>
<tr>
<td>VM</td>
<td>4.5</td>
<td>22</td>
<td>6.5</td>
</tr>
<tr>
<td><strong>Errors</strong></td>
<td>10.3</td>
<td>6</td>
<td>8.3</td>
</tr>
<tr>
<td>VP</td>
<td>7.4</td>
<td>5.7</td>
<td>33.5</td>
</tr>
<tr>
<td>CVM</td>
<td>5</td>
<td>5.7</td>
<td>5.7</td>
</tr>
<tr>
<td>VM</td>
<td>7.6</td>
<td>37.5</td>
<td>5</td>
</tr>
</tbody>
</table>

Data were collected on the percent of errors and number of minutes to complete each task under the three video interventions during the Comparison condition under each video intervention (Table 2). Overall, sessions with VP across the three students and three types of tasks resulted in the least amount of errors. All three students committed fewer errors when using VP for the multi-step cleaning tasks, and two of the three students committed fewer errors when using VP for the multi-cluster putting away items tasks and multi-component folding tasks. Examination of the average time to complete tasks across the three video interventions revealed minimal differences with the exception of Erin’s performance when completing the multi-component folding tasks. She required up to 20 min. (average 16.7 min.) when folding the towels using VM compared to an average of 8 min. (minimum 6 min.) when using CVM to fold the pants. No apparent pattern seemed to appear across the three video interventions in terms of task completion time and better performance time did not occur consistently across interventions.
not correlate directly with the superior treatments across participants and tasks.

**Best Treatment Condition**

During the Best Treatment condition, the most noticeable change occurred with the tasks within the multi-cluster (putting away items) and multi-step (cleaning) sets. When completing multi-cluster steps Erin and Macon were unable to reach criterion levels of performance with the three video interventions until the superior video intervention (VP for Erin and CVM for Macon) was applied to all sets. Elise had reached criterion levels with both VP and CVM during the Comparison condition, but only performed up to 75.9% of the steps using VM prior to the Best Treatment condition. When VP (superior video intervention) was applied to the VM set, she completed 100% of the steps correctly on the fourth session. For the multi-step cleaning set of tasks, all three students reached criterion levels with the VM tasks when VP was applied to those tasks.

When completing the multi-component folding tasks, Macon experienced no change in performance when the superior video intervention (VP) was applied to folding shirts (CVM tasks) and increased from 68.8% correct to 80% correct when folding pants (VM tasks). Elise experienced an increase in performance for only the VM task (folding shirts) when the superior video intervention (CVM) was applied and her performance on the VP task (folding pants) deteriorated from 98.8% correct to 87.5% correct when CVM was applied. Erin increased correct performance levels from 96.5% when folding shirts (Comparison condition) to 97.6% when the superior video intervention (VM) was applied to the VP tasks and reached criterion levels with folding pants (CVM task) when VM was applied in the Best Treatment condition.

**Discussion**

In this study, VP was more effective than VM and CVM for all students when completing multi-step tasks and for 2 of 3 students when completing tasks that were more discrete, multi-cluster tasks (i.e., putting away items on shelves). Application of VP to the VM tasks during the Best Treatment condition of the multi-step tasks resulted in criterion level performance for all students. Differences in favor of VP, for measures of efficiency (percent of errors) were noted for all students when completing multi-step tasks and for 2 of 3 students when completing multi-cluster tasks and multi-component tasks.

Results should also be evaluated in terms of the time required to produce each of the video interventions. Creation of the PowerPoint programs was identical for CVM and VM with the exception of adding the feature “loop continuously until esc” and inserting a 3 s delay between steps when making the CVM video recordings for multi-cluster tasks and multi-step tasks to allow for physical movement around the setting. The VP intervention for the multi-component tasks was comparable to those of VM and CVM because only one video recording was made for each item to be folded and only one PowerPoint slide was made for each sized item. The noticeable difference was with the production of VP for multi-cluster and multi-step tasks. Production of VP for the more discrete skill of putting away items required up to three times the amount of time required to produce the CVM programs two to eight times greater for the multi-step tasks when using VP due to the start and stop of the camera for each step and the amount of time required to save and title each clip and to insert each video clip into individual PowerPoint slides. The superior effects of the VP programs may warrant such an increase in time for some students, however, in light of the minimal difference in performance when using CVM and VP for the multi-step cleaning tasks in the current study, practitioners may opt to evaluate use of CVM for such tasks. A hierarchy may also exist whereby students who initially perform well with VP (a generally more intensive procedure in terms of set up and instructional requirements than VM), may learn to use less time intensive instructional procedures like VM or CVM.

**Limitations**

Results were mixed for the multi-component tasks in which steps within tasks were completed multiple times (i.e., folding a shirt five times). A limitation of the study may have
affected the mixed results for these multi-component tasks. Although the intent was to identify tasks that were functionally equivalent for comparison purposes, each student completed more steps correctly, regardless of the procedure, when folding towels. There are two possible explanations for this. First, students may have had more experience folding towels (although baseline performance did not indicate a noticeable difference) and second, folding towels may have been an easier task for students to perform than folding shirts and pants. When folding shirts and pants, the step “lay flat out on the table” was considered correct only if the student placed the clothing item in the identical orientation demonstrated on the video (waistbands, shirt collars/tops closer to the student). When folding towels, no such top/bottom orientation was required even though students were required to place the hand and bath towels lengthwise on the table. When the superior video interventions were applied to folding pants and shirts, Erin showed improvement in performance across both tasks and Elise and Macon showed improvement in only the tasks previously performed using VM and experienced deterioration in performance with the VP task (Elise) and CVM task (Macon). These results indicate that the task (folding towels), and not the interventions, may have influenced the results for two of the three students.

Another limitation was the omission of any maintenance or generalization data across the tasks and procedures. This information should be included when making decisions as to which VBI would be best for specific students and tasks. It is possible that with subsequent use of CVM, students may require additional training if the procedure is not used frequently. Likewise, procedures such as VP may be more readily generalized across tasks not evaluated in the current study.

Finally, the current study limited evaluation of social validity to student feedback. Teachers and practitioners responsible for creating video instruction should be consulted and made aware of the differences in production time in order to evaluate their perceptions of the benefits of each technology in light of the varying production time.

Implications for Future Research and Application

Since this study is the first to compare VM, VP, and the relatively newly explored procedure—CVM, a general recommendation is for further comparative research to be conducted using differing forms of VBI. With the rising interest and application of video interventions it is imperative that this line of comparative research continue.

The current study used the computer mouse to operate the VP programs. Future research and applications should examine use of touch screens on computer tablets or mobile technologies that may provide faster and more intuitive means for users to advance slides when using VP. Evaluation of students’ abilities to: operate VM and CVM programs independently; locate target programs from a list of visual menus; and operate programs which branch to additional menu options, should also be evaluated as a means to increase independence.

The inability to use VP, when a user’s hands are occupied or dirty, has implications in support of hands-free CVM or VM. The stop and start of VP may interrupt the flow of tasks (Mechling, Ayres, Bryant, et al., 2014) and tasks should be thoroughly evaluated to determine whether students’ hands will be free to operate the device and whether the stop/start process will hinder performance. Students in the current study also demonstrated the ability to complete steps by listening to voice-over directions in the video (rather than watching the video) when moving around the home living center, further supporting the inclusion of auditory cues when developing VBI (Mechling & Collins, 2012).

In spite of the advantages of hands-free operation of the video, all students in this study performed better and committed fewer errors across the multi-step cleaning tasks and 2 of the 3 students performed better and committed fewer errors across the multi-cluster tasks when using VP. In keeping with previous research, it should be recognized that VP may be more effective and efficient across some tasks and learners (Cannella-Malone et al., 2006; 2010).

Another consideration is the ability of users to immediately replay video steps when using VP in comparison to VM and CVM. Although
steps can be viewed repeatedly with CVM, the user is required to wait until the video loops around through all the subsequent and previous steps before viewing the target step again. This may increase task completion time or hinder the user who has difficulty identifying the target step in subsequent loops of the video. Another requirement of CVM is to complete steps in sync with the video which may be less intuitive to users and may require some form of history training to teach users to follow steps in sync with the video or to wait for the video to loop back around.

A further finding, when implementing this study, was that the instructor was necessary to move the laptop over to the refrigerator. When using VP or CVM it may be necessary to: provide a more portable, mobile device that can be worn by the student or readily moved about; or mount a device in such a way that the learner can view it from a distance (i.e., wide screen production).

Finally, the variation in performance across the three students indicates that student characteristics and learning styles may affect performance when the timing of prompts differ across forms of VBI. A further consideration is student preference for using differing forms of VBI (Taber-Doughty et al., 2008). When using VM in the current study, both Macon and Erin asked that the instructor to, “keep it running” (i.e., CVM) rather than sitting down and watching the complete video before starting the task and Erin asked to use the arrows. During measures of social validity students verbally confirmed these preferences. Self-determined selection of the form of VBI by the user, should be included when making decisions concerning methods of instruction. For research purposes student requests were not granted during this study, but in applied settings and perhaps future research, the effects on task performance when adhering to student requests should be evaluated.

References


Received: 17 July 2013,
Initial Acceptance: 19 September 2013,
Final Acceptance: 3 November 2013