

Effects of Video Prompting Without Voice-Over Narration Among Students With Autism Spectrum Disorder

Kyle D. Bennett and Christina Crocco
Florida International University

Tara O. Loughrey and
Logan S. McDowell
The Victory Center for Autism and Related
Disabilities, North Miami Beach, Florida

Video-based instruction (VBI) has been successfully used to teach skills to individuals with autism spectrum disorder and other developmental disabilities. Recent research efforts have focused on analyzing the components of the VBI intervention package, one of which is voice-over narration. The comparative studies on VBI with and without voice-over narration have produced conflicting results with some participants performing equally in both conditions. A potential reason for these results is a product of the adapted alternating treatments design used in those studies, specifically alternation effects. In the current study, we used a multiple probe design across participants to examine the effects of video prompting without voice-over narration in isolation. Results suggest that the intervention was not effective for 2 of the 3 participants. However, participants' performance increased once voice-over narration was added in a separate phase. These results are discussed along with implications for practice and future research.

Keywords: autism, video-based instruction, video prompting, voice-over narration

Researchers have repeatedly demonstrated the effectiveness of video-based instruction (VBI) to teach and prompt behaviors among students with autism spectrum disorder (ASD) and other developmental disabilities (Banda, Dogoe, & Matuszny, 2011; Miltenberger & Charlop, 2015). There are several types of VBI, and two of these are video modeling (VM) and video prompting (VP; Rayner, Denholm, & Sigafoos, 2009). When using VM, practitioners show a video of an entire skill being performed before requiring a student to attempt that skill (Mechling, Ayres, Bryant, & Foster, 2014). When using VP, practitioners show one clip of the video before requiring students to emit the skill, and this repeats until all task steps have

been attempted (Cannella-Malone, Wheaton, Wu, Tullis, & Park, 2012).

Success with VBI is theorized to correlate with generalized imitation (Rayner, 2011). During the course of early development, typically developing children begin to imitate the actions of those around them between the ages of 6 and 24 months (Nielsen & Dissanayake, 2004). This behavior is then reinforced through increasing opportunities for social engagement with the caregiver and other important adults in the child's life (Pelaez, Virues-Ortega, & Gewirtz, 2011). In children with ASD, the development of imitation does not typically occur in this manner (Ledford & Wolery, 2011). Instead, imitation skills are taught, often through the use of discrete trials with the incorporation of planned reinforcement (Brown, Brown, & Poulson, 2008). Over time, this repertoire is continually reinforced and shaped in an effort to create the generalized imitative repertoire, which typically developing children gain through early interactions with their natural environment (Pelaez et al., 2011). Although the research in this area is mixed, there is some evidence to suggest that the presence of a generalized imitative repertoire is a necessary prerequisite to the successful use of VBI procedures (Rayner, 2011).

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Kyle D. Bennett and Christina Crocco, Department of Teaching and Learning, Florida International University; Tara O. Loughrey and Logan S. McDowell, The Victory Center for Autism and Related Disabilities, North Miami Beach, Florida.

Correspondence concerning this article should be addressed to Kyle D. Bennett, Department of Teaching and Learning, Florida International University, Miami, FL 33199. E-mail: kyle.bennett@fiu.edu

Alternatively, certain studies have demonstrated that VBI procedures can be used to teach imitation to children with ASD, thereby contradicting the idea that generalized imitation is an essential prerequisite for the use of VBI. In these studies, young children with ASD were taught to imitate basic motor actions via video-based presentations (Cardon & Wilcox, 2011; McDowell, Gutierrez, & Bennett, 2015). The results of these studies indicated that prompting and reinforcement are likely important components in early imitation training regardless of modality (VBI or in vivo) as participants with little to no prior imitation skills were able to learn to imitate via VBI. These results imply that VBI can, when implemented in this manner, be an effective teaching technique in the absence of a generalized imitative repertoire, and further illustrates the need for continued research in this area.

Video-based instruction typically involves multiple components, including additional response prompting and error correction, to name a few (Banda et al., 2011). A recent shift in researching VBI intervention packages has been examining the relative effectiveness of the various components and parameters of VBI treatment packages. For instance, researchers have investigated the effects of VM with and without graduated guidance (Akmanoglu, Yanardag, & Batu, 2014), the effects of VP with and without error correction (Cannella-Malone et al., 2012), the effects of VM and VP using differing screen sizes (Mechling & Ayres, 2012; Miltenberger & Charlop, 2015), the influence of the type of model used on the video (e.g., child actor vs. adult actor; Rayner, 2011), and the perspective from which the video was made (e.g., point of view, scene view, and combined point of view with scene view; Spencer, Mechling, & Ivey, 2015).

Another set of comparative VBI studies involved examining VM and VP with and without voice-over instructions that accompanied the video clips. Mechling and Collins (2012) examined VM with and without voice-over narration among individuals with moderate intellectual disability learning cooking skills. Additional prompting procedures were not reported but general praise statements were delivered contingent on performance. These researchers found that VM with voice-over narration was more effective for three participants while VM

without voice-over narration was better for the remaining participant.

In a related study, Bennett, Gutierrez, and Honsberger (2013) explored the use of VP with and without voice-over narration among five adolescents with ASD. Three clerical skills (i.e., making photocopies, making a label for files, and sending a fax) were targeted for intervention. Praise statements followed correct responding; however, no additional response prompts were used. Results showed that VP with voice-over narration was more effective for one participant, VP without voice-over narration was better for two participants, and that both interventions were equally effective for the remaining participants.

In a similar study, Smith, Ayres, Mechling, and Smith (2013) examined VM with and without voice-over narration among adolescents with ASD learning to set up and prepare a social gathering (e.g., prepare a party banner, prepare snacks and beverages, set up board games). Verbal praise was provided contingent on correct responding and additional response prompts were not used. These authors reported that the voice-over narration condition was more efficient for two participants while both VM with and without voice-over narration were equally effective for the remaining two participants.

The findings from these studies represent mixed results regarding the utility of voice-over narration as a component of VBI interventions. Moreover, differences were negligible among the participants in the Bennett et al. (2013) study differing by only one step correct in most situations. One possibility for these mixed results is that there are idiosyncratic behavior repertoires among the participants that make one intervention more or less effective. Another possibility for those individuals for whom the interventions were equally (or nearly equally) effective may be a function of the particular single-subject research design used in the studies.

A common experimental design used in VBI comparative studies is the adapted alternating treatments design (AATD), and this was the case for the aforementioned studies examining VM or VP with and without voice-over narration. Unlike the traditional alternating treatments design where two or more independent variables are manipulated with a single depen-

dent variable, the AATD permits researchers to rapidly compare the effects of two or more independent variables on two or more separate but equivalent dependent variables (i.e., behaviors) that are irreversible (Wolery, Gast, & Hammond, 2010). The implementation of the AATD by Bennett et al. (2013), Mechling and Collins (2012), and Smith et al. (2013) was implemented as recommended by Wolery et al. (2010) as these researchers implemented design tactics to address threats to internal validity. However, Hains and Baer (1989) posited that sequence effects, which according to these authors include carry-over effects and alternation effects, cannot be mitigated, but rather observed. Indeed, one issue among designs that rapidly alternate treatments that Hains and Baer (1989) highlighted is the possibility that the effects of multiple interventions that are alternated might produce different results from when those interventions are studied in isolation. Perhaps this is the case when examining VBI with and without voice-over narration, as it is possible that one of the conditions is setting the occasion for responding in the other condition. That is, exposure to VBI with voice-over narration may form a response class, which produces generalized effects for imitating video models in the other condition.

In addition to this methodological concern, there is a pragmatic issue that must be addressed. Researchers, teachers, related service providers, and caregivers need to know the effects of including or not including voice-over narration on the performance of individuals with ASD. Others have postulated that individuals with ASD have a stronger visual learning channel when compared to other learning channels (e.g., auditory; Quill, 1995). However, it is important to know the influence, or lack thereof, that voice-over narration has on student performance when engaged in VBI. Voice-over narration as an intervention tactic might not be available or appropriate in certain conditions. For example, voice-over narration might be difficult to hear in noisy work conditions such as commercial kitchens or automotive repair centers. Likewise, voice-over narration might not be entirely acceptable in other environments such as employment sites that are customer service oriented. Therefore, the purpose of this study was to examine the effects of VP without voice-over narration on the skill performance of

individuals with ASD. The first research question is the primary purpose of the study. The second research question was posed in an effort to bring participants' performance to criterion in the case that VP without voice-over narration was ineffective. The research questions were as follows:

1. What are the effects of VP without using voice-over narration on the performance of students with ASD washing towels in a washing machine?
2. If the participants' performances were below criterion, would the addition of voice-over narration increase their performance?

Method

Participants

Three students participated in this study. Each participant had a community diagnosis of ASD and attended a school exclusively designed for students with ASD and similar developmental disabilities. A fourth student participated in early sessions of the study but was withdrawn due to excessive absences. Kyle D. Bennett and Tara O. Loughrey completed the Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Rothen-Renner, 1988) on each participant. Pseudonyms are used to protect participants' identities.

Michael was a male student, age 11 years and 10 months. His score on the CARS was 34, which placed him in the mildly moderately autistic range of ASD according to this scale. He could communicate using single words along with modified sign language. He was able to follow multiple one- and two-step receptive directions. Additionally, his imitation score on the CARS equaled 2, indicating mildly abnormal imitation. He could imitate single gross motor movements with and without objects. However, he could imitate few fine motor skills. He had no prior experience with VBI, and his use of an iPad was limited to watching videos. He could not search for videos or access them; however, he could manipulate the start/stop and pause features while watching videos.

Christian was a male student age 15 years and 1 month. His score on the CARS was 44.5, and this placed him in the severely autistic range of ASD on this scale. He could independently re-

quest and protest using approximately 10 single-word approximations. He was able to follow multiple one-step receptive directions. Moreover, he could imitate multiple single gross motor movements, as well as several fine motor movements. He also could imitate actions with objects. His score on the imitation section of the CARS equaled 2, indicating mildly abnormal imitation. Christian did not have prior experience with VBI. Furthermore, he did not use an iPad prior to this study.

Sam was a 12-year, 2-month-old male student. His score on the CARS was 37.5, placing him in the severely autistic range of ASD on this scale. He could communicate independently using one- to three-word phrases. He could also follow multiple one- and two-step receptive directions, and he was able to imitate gross and fine motor movements. His imitation score on the CARS equaled 1.5, which is slightly below what would be considered appropriate imitation on that scale. Additionally, Sam's mother reported that she briefly attempted VBI a year before the study started but had not been using the strategy since that time. He used an iPad for entertainment (e.g., watch videos, listen to music, and play games), to communicate, and to complete simple math assignments. He could access items on the iPad and manipulate the features of the iPad without assistance.

Settings and Materials

This study was conducted at a school for students with ASD and related developmental disabilities. Sessions were conducted in a laundry/utility room of a house on the campus grounds. The house was routinely used to teach a variety of daily living skills to students. There was a washer, dryer, small refrigerator, hot water heater, and air conditioning unit in the room. During this study, we focused on washing towels, and thus, used the washing machine. All the dials on the washing machine were preset for the participants and performance of those skills were not part of this study. Three white towels measuring 14.5×15 inches were inside a circular laundry basket that was in front of the washing machine. All brand detergent Free and Clear Mighty Pacs (hereinafter referred to as *detergent pods*) were in a hard container with a circular plastic lid that was loosened and left

setting on top of the container. Tide detergent pods were used briefly with one participant in the study (see the Procedures section for details). The container was located on a chair in front of and to the left of the washing machine. This arrangement required participants to turn 90° away from the washing machine to obtain a detergent pod and then turn back to the washing machine. This set up was necessary due to space limitations in the room.

Kyle D. Bennett recorded video clips using an iPhone 6 Plus. Video clips were shot from a first-person perspective displaying an adult's hand and arm. These clips were embedded in Apple Keynote presentation software and played on an iPad 2 (screen size measuring 7.81×5.84 inches). Video clips ranged from 6 to 13 s, and each slide contained one clip. During a video with narration phase, audio was played on a Phillips portable Bluetooth speaker (Model no. SBT300RG/37).

Dependent Variable and Data Collection

The dependent variable was number of task steps completed correctly for the task of washing towels. A task analysis of the behavior chain, with corresponding voice-over narration statements, is presented in Table 1. A plus (+) was scored if participants completed a step correctly. A minus (−) was scored if participants did not initiate a task step within 30 s (latency error) or completed the step incorrectly (topographical error).

Experimental Design

We used a multiple probe design across participants to examine the effects of VP on the acquisition of washing towels among students with ASD. The multiple-probe design permits researchers to predict, verify, and replicate findings allowing the determination of a functional relation between the independent and dependent variables. Moreover, the multiple-probe design prevents participants from experiencing continuous baseline conditions, which could be impractical or unethical in certain situations (Richards, Taylor, & Ramasamy, 2014).

We conducted sessions 1–2 times per day, 1–4 days per week (weekly sessions varied due to school closings or participant unavailability). Each session involved participants having one opportunity to complete the task analysis steps.

Table 1
*Task Analysis of Washing Towels and Corresponding Voice-Over
 Narration Statements*

Task steps	Voice-over narration statements
1. Open the lid of the washing machine	1. "Open lid."
2. Put the towels in the washing machine	2. "Put in."
3. Open the lid to the detergent container	3. "Take off."
4. Put the detergent pod in the washing machine	4. "Put in."
5. Close the lid to the detergent container	5. "Put on."
6. Close the lid of the washing machine	6. "Close lid."
7. Press the start button	7. "Press start."

There was a baseline condition followed by a staggered introduction of the experimental condition across the participants. The intervention was implemented with the first participant with stable responding during baseline. (Note that the participant that was withdrawn from the study was the first participant with whom intervention was added. This individual participated in continuous baseline sessions without probe sessions being conducted while the remaining students participated in continuous baseline sessions followed by probe sessions as is recommended [see Richards et al., 2014].) The intervention was added to subsequent participants when their baseline data were stable and the previous participant's intervention data were stable, as well. Video prompting without voice-over narration was the first phase of the experimental condition. However, voice-over narration was added (volume unmuted) as a second phase for all participants because the data for Michael and Christian demonstrated low levels of responding, and Sam experienced difficulty completing two of the task steps (he engaged in stereotypy squeezing the detergent pods repeatedly and this behavior competed with completing the task steps). The intervention was withdrawn for Michael who met our mastery criterion, which was 100% of task steps correct for three sessions. Following stable responding during the withdrawal condition, VP with voice-over narration was reinstated until stability was achieved for Michael. Note that other researchers have reported the use of add-on procedures in different conditions/phases of a study to potentially produce clinically significant results for the participants (see Kleeberger & Miranda, 2010).

Procedures

Baseline. Kyle D. Bennett conducted individual sessions with participants. Each session started with Bennett giving the instruction, "Wash clothes." Participants could complete task steps out of sequence relative to the task analysis presented in Table 1, and they were given an unlimited amount of time to complete task steps provided they were attempting to do so. Erred and omitted steps were ignored. However, if the participant committed the same error for 30 s or the erred behavior was destructive to the materials, the session was terminated. Finally, participants were given 30 s to initiate task steps. Once 30 s elapsed with no responding, the session was discontinued. These baseline procedures were similar to a single opportunity assessment procedure, and other researchers have reported using similar baseline procedures in the peer-reviewed literature (e.g., Cannella-Malone et al., 2012; Cihak, Alberto, Taber-Doughty, & Gamma, 2006; Kurt & Tekin-Iftar, 2008).

Video prompting without voice-over narration. Kyle D. Bennett conducted sessions with participants individually, and he controlled the iPad to mitigate potential confounds related to participants' potential inaccuracies manipulating the device. Sessions started with Bennett giving the instruction, "Wash clothes." This was followed by Bennett giving the direction, "Watch this" while playing the first video clip for the participant. During this phase, the voice-over narration was muted. If the participant was not viewing the video, Bennett gave the instruction, "Look" and replayed that video clip. The procedure was to give this prompt no more than three times on a given step with the

intention of scoring the step as an error after the third prompt. However, participants did not require this prompt more than two times. Once the video clip ended, Bennett gave the instruction, "Now you do it." Correct responses resulted in praise statements. If the participant made an error or was nonresponsive for 30 s on a step, Bennett asked the participant to turn around and then completed that step out of their view. This was done so that the relevant stimulus conditions could be set up for instruction on the next task step in the chain. These procedures were implemented until all steps of the chain were attempted. No other response or stimulus prompting strategies were used.

Video prompting with voice-over narration.

Video prompting with voice-over narration sessions were conducted identically to the VP without voice-over narration sessions with the exception being that a one sentence voice-over direction was played through the portable Bluetooth speaker. This phase was implemented with Michael and Christian due to low levels of responding and evidence of a descending trend (Christian only). This phase was also implemented with Sam because he emitted stereotyping during Step 4 (i.e., put the detergent pod in the washing machine) and Step 5 (i.e., close the lid of the detergent container). That is, he would try to squeeze the soft detergent pods repeatedly, which interfered with his performance on these steps. This change in tactic did not lead to Sam completing these steps successfully. Therefore, we replaced the soft detergent pods with the aforementioned hard detergent pods with the gel portion drained out prior to Session 7 of the VP with voice-over narration phase. Our intention was to mitigate the competing source of stimulation so that VP could be fairly evaluated. This was effective for Step 5 but not Step 4. As in the prior condition, no additional response or stimulus prompting was added.

Withdrawal and reintroduction of video prompting with narration. Our criterion for withdrawing the intervention was 100% of task steps correct for at least three sessions. This criterion was selected to ensure that each component of the behavior chain developed, giving participants the opportunity to perform the entire skill correctly. Partially developed chains would likely not result in independent task completion among participants. Michael was the only student that met this criterion. The with-

draw condition was conducted identically to baseline. Following stable responding during the withdraw condition, VP with voice-over narration was reintroduced. These sessions were conducted identically to the original VP with voice-over narration sessions.

Interobserver Agreement

Two observers independently recorded interobserver agreement (IOA) across 73.77% of all sessions and across all participants. The point-by-point agreement procedure was used, requiring the observers to record the same code on matching task steps for an agreement to be scored (Kazdin, 1982). We calculated IOA by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Interobserver agreement equaled 100% (Richards et al., 2014).

Treatment Fidelity

Treatment fidelity (TF) data were collected by a second observer across 70.49% of baseline and experimental sessions on each of the procedural steps listed in the Procedures section. A plus (+) was scored for procedures implemented accurately and a minus (−) was scored for procedures implemented incorrectly. Treatment fidelity was calculated by dividing the number of correctly implemented procedures by the total number of planned procedures and then multiplying by 100 (Gast, 2010). For this study, TF equaled 98.49% (range 85.71%–100%). Kyle D. Bennett made the following errors during the study. In two instances (once with Michael and once with Christian), Bennett did not give the direction, "Wash clothes" and instead directed the participants to watch the video. Also, in one instance Bennett did not place the towels in the washing machine following one participant not engaging in that step during intervention. However, this did not affect the participant's opportunity to perform correctly on future steps. Additionally, in two instances the video advanced to the next clip when Bennett touched the iPad screen to replay a video clip due to participants not looking at the video.

Results

Number of task steps completed correctly is presented in Figure 1. Sessions are presented on

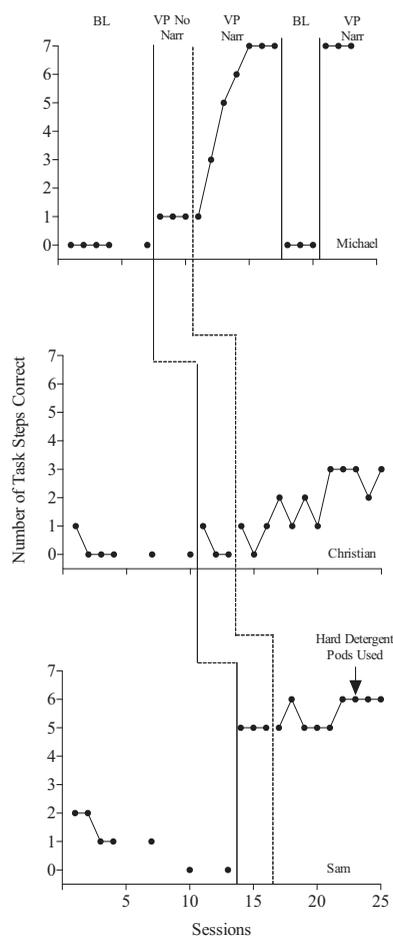


Figure 1. Number of task steps completed correctly washing towels. BL = baseline; VP = video prompting; Narr = narration.

the x-axis and number of task steps correct is presented on the y-axis. Overall, there were mixed results among the participants (see Figure 1).

The first graph in Figure 1 represents the data for Michael. During baseline, his mean level of responding was zero steps completed correctly. This data path was stable with a zero celerating trend. Once VP without voice-over narration was implemented, there was a slight increase in mean level of responding ($M = 1$, range = 1–1). These data were stable with a zero celerating trend. During the next phase of this condition, VP with voice-over narration, Michael demonstrated a more substantial level shift emitting an average of 5.14 steps correctly with

a range from 1 to 7 steps correct. The data path had a steep ascending trend with the final three data points stabilizing at the mastery criterion. Once VP with voice-over narration was withdrawn, Michael emitted zero steps correctly for each session in this condition. These data were stable with a zero celerating trend, and the data represents a significant level shift. However, once VP with voice-over narration was reintroduced, his mean level of responding returned to the mastery criterion ($M = 7$, range = 7–7).

Christian's data are represented in the second graph of Figure 1. His mean level of responding during baseline was 0.17 steps completed correctly, ranging from 0 to 1 step correct. These data had an overall slight descending trend, but five of the six data points had a zero celerating trend and were stable. Once VP without voice-over narration was implemented, there was a negligible increase in responding ($M = 0.33$; range = 0–1 step correct). These data were stable but had a descending trend. When VP with voice-over narration was implemented, there was a slight increase in mean level of responding ($M = 1.83$; range = 0–3 steps correct). There was an overall ascending trend of this data path with the last five data points representing stable, but low levels of responding. This participant did not meet the criterion, and therefore, the intervention was not withdrawn.

The final graph in Figure 1 represents the performance of Sam. During baseline, he emitted low levels of correct responding ($M = 1$; range = 0–2). The data path had a descending trend throughout the condition. Once VP without voice-over narration was implemented, Sam's performance increased ($M = 5$; range = 5–5). These data were stable with a zero celerating trend. During the VP with voice-over narration condition, there was a slight increase in level ($M = 5.56$; range = 5–6 steps correct). This participant consistently emitted Step 4 (i.e., putting the detergent pod in the washing machine) incorrectly by repeatedly squeezing the soft detergent pod. Additionally, Step 5 (i.e., closing the lid on the detergent container) was inconsistently implemented. Therefore, at Session 7 of this phase of the condition, a hard detergent pod was introduced to mitigate the stereotypy. This had no effect on Step 4; however, he did emit Step 5 more consistently following this change. Overall, Sam's perfor-

mance improved but did not meet the mastery criterion, and thus, the intervention was not withdrawn.

Discussion

The primary purpose of this study was to examine the effects of VP without voice-over narration on the skill acquisition of washing towels by students with ASD. Other researchers have explored the effects of VBI with and without voice-over narration to understand the relative effectiveness of voice-over narration as a component of the intervention package. Overall, this line of research has produced mixed results (Bennett et al., 2013; Mechling & Collins, 2012; Smith et al., 2013). More at issue with this line of comparative studies is the number of participants for whom interventions were equally effective or where there were marginal differences among the intervention components. Although it is possible these results were due to individual differences among the participants, another possibility is alternation effects as a product of the AATD used in those studies.

The results from the current study suggest that VP without voice-over narration was not effective for Michael and Christian as the data suggested low levels of responding along with a descending trend for Christian. However, the data also suggest that VP without voice-over narration was effective for Sam although there is a lack of practical significance given he never completed all the steps of the task. Notwithstanding issues with practical significance, there was an immediate level shift once that condition was implemented with him, and the only errors were likely due to the competing stimulation of squeezing the soft detergent pods. It is important to note that Sam had prior experience with VBI a year before this study was conducted. Although VBI was not used in the year leading up to the current investigation, it may be that prior exposure to VBI produced learning effects that primed him to view the videos and imitate the actor's behaviors irrespective of voice-over narration. This is an empirical issue that warrants further research.

Once VP with voice-over narration was added, Michael's performance increased steadily until mastery was achieved. Christian did not achieve mastery during this phase of the intervention but he did demonstrate a modest

improvement in washing towels. The lack of acquisition by Christian was not due to motor deficits or stereotypy. Moreover, he attended to the video clips and demonstrated imitation skills when following a live model prior to the study. Perhaps other prerequisite skills for following video prompts/models were not part of Christian's repertoire. MacDonald, Dickson, Martineau, and Ahearn (2015) reported that delayed imitation and delayed match-to-sample skills were associated with individuals with ASD following video models. These skills, however, were not measured among participants in this study. Finally, VP with voice-over narration had no additional effect on Sam's competing behavior of squeezing the soft detergent pod, and this behavior continued to interfere with his performance. The addition of hard detergent pods did not affect Step 4 of the task analysis (i.e., putting the pod in the washing machine) but it appeared to assist with the subsequent step of closing the lid on the detergent container (prior to adding the hard detergent pod, he continued to reach in the container and squeeze the soft detergent pods).

The results of this study also suggest that VP with voice-over narration did not produce independent responding once it was withdrawn for Michael. Others have reported similar results and resolved this issue by implementing a fading procedure (Sigafos et al., 2007). Ultimately, independence from prompting, including video prompting, is the goal of instruction. However, this might not be possible for some individuals, and one of the advantageous features of VBI is that the "video prompts" do not necessarily have to be removed as the video system can evoke correct responding independent of a caregiver, teacher, supervisor, or others.

One further possible explanation for the variability in results across participants is related to the presence or absence of a truly generalized imitative repertoire. Given the participants results on the CARS, there is demonstrable evidence that each of the participants had the skill to imitate the actions of others. Although those skills were limited when compared to typical development, each participant's score fell between the categories of mildly abnormal and slightly below appropriate levels, thereby demonstrating that this was not an area of severe impairment.

However, it is possible that with a subset of individuals, there was a failure to generalize this imitative repertoire to novel stimuli, or in the case of VBI, a novel presentation modality. This is particularly likely in this study given that Christian, the participant for whom VBI both with and without voice-over narration was least effective, received the highest score on the CARS indicating the most severe symptomatology of the three participants. Knowing that a failure to learn from the natural environment and generalization are considered hallmarks of an autism diagnosis, one can logically deduce that individuals with more severe diagnoses may experience greater difficulty generalizing skills, and therefore, greater difficulty imitating behavior given a novel presentation modality (Young, Krantz, McClannahan, & Poulson, 1994). As several previous studies have found similar individual differences in the effectiveness of VBI procedures, in the future it may be worthwhile to assess participants' ability to generalize skills as a possible predictor of the effectiveness of VBI (Gutierrez, Bennett, McDowell, Cramer, & Crocco, 2016; Kleeberger & Mirenda, 2010; McDowell, Gutierrez, & Bennett, 2015).

Furthermore, the lack of generalized imitation commonly seen in individuals with ASD may contribute to the differences in effectiveness between the with and without voice-over narration conditions. When following a video model with voice-over narration, two behavioral repertoires are simultaneously occurring. Participants are both imitating the behavior of another person, and following simple instructions. Given the often-severe deficit in imitation found in individuals with ASD, it may be that including voice-over narration allows participants to rely on an ability to follow instructions without having to resort to imitating a model. The opportunity to rely on the voice-over narration alone may be in part responsible for the better performances seen in the with voice-over narration condition of this study.

A final issue that deserves attention is the limited number of VP without voice-over narration sessions to which the participants were exposed. Three data points are sufficient to determine the level and trend of a data path provided the data are stable (Gast & Spriggs, 2010; Kratochwill et al., 2013). This was the case for each participant in this study. Our rationale to

end that phase was related to practical and ethical concerns with continuing intervention sessions where there was evidence of persistent low levels of responding for Michael and Christian. These individuals watched each video clip and were given 30 s to respond each time. After three sessions without any progress, we added voice-over narration to mitigate exposing the participants any further to a seemingly ineffective intervention. Although additional exposure could have resulted in better performance (MacDuff, Krantz, & McClannahan, 2001), it could have also resulted in continued errors and even problem behavior among the participants (Munk & Repp, 1994).

Limitations

There are several limitations that warrant consideration when interpreting the results of the current study. First, we withdrew a participant due to excessive absences. Attrition is a potential confounding variable in research but we estimated that a fair evaluation of the intervention was less likely in this situation. Second, we used a baseline procedure similar to the single opportunity assessment. This could have suppressed baseline responding for some participants. However, we allowed participants to skip steps as well as commit errors without terminating sessions (provided the errors were not destructive or continuous), and this might mitigate some concerns. Third, we did not attempt to fade VP from Michael's sessions. Although a VP system can potentially help achieve independence without adult prompts, it did not facilitate complete independence in this case. Fourth, correct task completion was followed by verbal praise; however, we did not empirically evaluate whether verbal praise functioned as a reinforcer for participants. Fifth, we implemented VP with voice-over narration directly following VP without voice-over narration to examine the potential for clinically relevant results, and others have reported using similar tactics in the peer-reviewed literature (e.g., Kleeberger & Mirenda, 2010). Nevertheless, this B-C sequence limits our findings since it is possible that VP with voice-over narration was effective because it followed VP without voice-over narration. Finally, we assessed participants' abilities to immediately imitate the actions of an adult model. Child demonstration

of an immediate imitation repertoire has been assumed to be a skill that predicts child performance when using VM, in particular (MacDonald et al., 2015). However, recent data from MacDonald et al. (2015) suggested that delayed imitation of actions and delayed match-to-sample tasks were two important skills that might lead to successful implementation of VM procedures with children with ASD. In this study, we did not evaluate participants' abilities to emit these repertoires. Perhaps participants with these skills would perform well using VBI whether or not voice-over narration was part of the intervention package. This, however, is an empirical question for researchers exploring the influence of voice-over narration on VBI intervention packages.

Implications and Future Directions

The results of the current study suggest that VP without voice-over narration was not effective for two participants. However, it was effective for the third participant, although the practical significance of the results for this individual is questionable. Once voice-over narration was added, improvements were noted for each participant. Again, however, enthusiasm must be tempered as the issue of practical significance is questionable given that the intervention could not be faded from Michael's sessions, and Christian and Sam did not complete all steps of the task. One possible reason for these results is that the intervention was not implemented with additional response prompting (e.g., gesture or physical prompts) or error correction strategies. Researchers have noted that such prompting strategies have been used in other VBI studies to evoke correct responding (Banda et al., 2011). Perhaps the addition of these tactics would have improved responding; however, the use of such add-on strategies leads to questions as to which components of these treatment packages are responsible for behavior change.

Thus, additional research is needed not only on the effects of VP without voice-over narration, but other component and parametric analyses are needed to fine-tune the approach for practitioners and caregivers implementing the strategy with individuals in need. Moreover, research into the influence of a generalized imitation repertoire on the use of VBI among

individuals with ASD is needed since there are conflicting accounts as to its influence on the effects of the intervention with this population. Such research may guide practitioners and caregivers to implement effective VBI interventions.

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