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Use of Video Modeling and Video Prompting Interventions for Teaching Daily Living Skills to Individuals With Autism Spectrum Disorders: A Review

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Identifying methods to increase the independent functioning of individuals with autism spectrum disorders (ASD) is vital in enhancing their quality of life; teaching students with ASD daily living skills can foster independent functioning. This review examines interventions that implement video modeling and/or prompting to teach individuals with ASD daily living skills. The findings suggest that daily living skills can effectively be taught through technology-enhanced methods, with video prompting reported as being an effective intervention method and video modeling being somewhat effective at increasing skill acquisition for students with ASD. Future research must address the effect that various components of the interventions (e.g., model type, perspective, length of video, error correction procedures, prompting fading, voiceover, method of viewing the video) have on student performance.

DESCRIPTORS: autism, video modeling, video prompting, functional skills, daily living skills

Performing functional skills with as much independence as possible can contribute to a person's meaningful participation in society and overall quality of life (Carnahan, Hume, Clarke, & Borders, 2009). Identifying ways to increase the independence of individuals with disabilities, including those with autism spectrum disorders (ASD), has been cited as vitally important in special education research and practice (Shipley-Benamou, Lutzker, & Taubman, 2002). For individuals with ASD, independence has been described as being a critical factor in successful community inclusion and employment (Carnahan et al., 2009; Hume, Loftin, & Lantz, 2009). Teaching skills to students with ASD that increase independence should be a priority in their educational programs; instruction in daily living skills can help foster this independence.

ASD can be defined as "a neuropsychiatric disorder that is characterized by severe and sustained impairments in social interaction, deviance in communication, and patterns of behavior and interest that are restricted, stereotyped, or both" (Volkmar & Pauls, 2003, p. 1133). According to the Diagnostic and Statistical Manual of Mental Disorders: 4th edition (DSM-IV), some of the characteristics used to diagnose ASD can include marked impairments in the use of multiple nonverbal behaviors, lack of social or emotional reciprocity, delay or total lack of developmental spoken language, inflexible adherence to routines, and persistent preoccupation with objects (American Psychiatric Association, 2000). In addition, some individuals with ASD have unique learning challenges such as impairments in attention (Quill, 1997), joint attention and imitation (Hume et al., 2009), verbal information processing (López & Leekam, 2003), initiation (Bramham et al., 2009), planning (Bramham et al., 2009), memory (Kemper & Bauman, 1998; Southwick et al., 2011), difficulties in rapid shifting of attention between visual and auditory stimuli (Ciesielski, Courchesne, & Elmasian, 1990; Garretson, Fein, & Waterhouse, 1990), as well as impaired focus on the most salient features of objects (Hume et al., 2009; Quill, 1997). Individuals with ASD have been described in some research as having strong visual processing abilities (McCoy & Hermansen, 2007) in addition to showing a preference for visual information as compared to auditory alone (Arthur-Kelly, Sigafoos, Green, Mathisen, & Arthur-Kelly, 2009; Cihak, 2011; Cihak & Schrader, 2009; Quill, 1997). Similarly, individuals with ASD have been reported to respond to visual input as a primary way of receiving information (Cihak, 2011; Hermelin & O'Connor, 1970). Visually based modeling procedures, such as video modeling (VM) and video prompting (VP), logically appear to build on the processing preferences of individuals with ASDs, while increasing student independence through learning new skills.

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Children learn a vast array of skills by observing others (Bellini & Akullian, 2007). In his discussions on social learning theory, Bandura (1977) highlighted the fact that most behavior is learned through modeling or observing another person performing a given behavior, which later acts as a guide when individuals form symbolic representations of what was modeled. In addition, both motivation and attention play a critical role in the ability of and individual to effectively learn an observed behavior (Bellini & Akullian, 2007). Observational learning through VM and VP can serve to not only mirror the learning strengths and sometimes preferred instructional style of individuals with ASD but the rationale for the efficacy of using such visually based instructional supports can be supported by the social learning theory as well because individuals with autism typically need direct instruction in a skill as a result of poor incidental learning abilities (McCoy & Hermansen, 2007). Video-based instruction can help address some of these core impairments that children with ASD exhibit (Delano, 2007).

VM is an instructional technique in which individuals view a short video of a model (e.g., adult, peer, self) performing a sequence of steps making up a target skill or behavior and then are directed to perform the steps viewed. Researchers have used VM to teach students with developmental disabilities and ASD a variety of functional daily living skills (i.e., domestic skills) including cooking-related skills (Mechling & Stephens, 2009; Rehfeldt, Dahman, Young, Cherry, & Davis, 2003; Shipley-Benamou et al., 2002; Van Laarhoven, Zurita, Johnson, Grider, & Grider, 2009), safety skills (Mechling, Gast, & Gustafson, 2009), cleaning a sink (Van Laarhoven et al., 2009), caring for a pet (Shipley-Benamou et al., 2002), setting a table (Shipley-Benamou et al., 2002), purchasing skills (Alcantara, 1994), making a bed (Lasater & Brady, 1995), changing batteries in household devices (Van Laarhoven et al., 2009), and grooming tasks (Charlop-Christy, Le, & Freeman, 2000; Lasater & Brady, 1995). Researchers also have incorporated a variety of technology devices such as computers and personal digital assistants (PDAs) when showing VM to students. Support for VM has been strengthened by research suggesting this instructional method has the potential to motivate students with ASD through the use of technology but also teach them salient features of a skill in an explicit manner (Shipley-Benamou et al., 2002).

Videos can be filmed from two different perspectives: the performers' perspective (i.e., first-person perspective), commonly known as point-of-view (POV) perspective, or from the spectators' perspective (i.e., third-person perspective). Given that individuals with ASD often have poor attention skill and a tendency to attend to irrelevant details of a task (Travers, Klinger, & Klinger, 2011), directing an individual's attention to the critical feature(s) of a given task may be beneficial to target critical information needed to perform the skill. POV perspective has been gaining popularity among interventionists, as this perspective typically involves showing just the hands of the performer completing a given skill, thereby narrowing the center of focus for the viewer. Instructors must consider what type of skill is being taught and which perspective will best allow their student(s) to grasp the necessary content from the video model without providing too much unnecessary distracting information or providing too little contextual stimuli in order for the student to be able to successfully complete a given skill. Additional research comparing the efficacy of spectator and POV perspectives would benefit the field.

In addition to having the video filmed in a particular perspective, the type of model used in the video (e.g., familiar adult, unfamiliar adult, peer, or self) must also be considered. Although one perspective or model type does not stand out as being more effective than others, researchers have stated that children are most likely to attend to a model they see as competent or similar to themselves (Bellini & Akullian, 2007). In their review on video model types and associated effects, McCoy and Hermansen (2007) reported that between 1987 and 2006, most studies reviewed incorporated peer modeling followed by use of adult models. Researchers also suggested that peer and self-models may be more influential with the success of video models used for students with ASD (McCoy & Hermansen, 2007). Current literature also advises that the decision for which perspective is used be individualized and take into account participant skills and characteristics.

Modeling procedures, including video and live modeling, have been reported as an established instructional practice in a systematic review conducted by the National Autism Center in their National Standards Report (2009), which provided the field with levels of scientific evidence that support the wide variety of educational and behavioral treatments that currently exist and are used with individuals with ASD. Established treatments, the highest classification rating in the review, are those that have several well-controlled studies that have shown beneficial effects for participants. VM has also been defined as an evidence-based practice for individuals with ASD by Odom and colleagues at the National Professional Development Center on Autism Spectrum Disorders (2010). It remains imperative that researchers strive to conduct high-quality research to enhance the strength of the conclusions for interventions implemented. In recent years, Horner et al.'s (2005) quality indicators for single-subject research have been used to help identify evidence based practices in the literature as well. Such findings should continue to be reported in future research, including literature reviews and meta-analyses.

Some of the proposed benefits of VM cited in the literature indicate that this instructional method is less intrusive and time intensive than in vivo (i.e., live) modeling because one recording of a task can be made and shown multiple times to afford the student opportunities for repeated practice (Biederman, Stepaniuk, Davey, Raven, & Ahn, 1999; Delano, 2007). Also, minimal staff training on instructional delivery needs to take place as the video is pre-recorded and thus can provide standardization among practice sessions. Furthermore, VM is thought to provide teachers who have limited ability to conduct instruction in naturalistic settings (e.g., limited transportation, budget, staff support, etc.) with a method of instruction that can simulate real life settings and activities and enable students time to practice skills before experiencing them in the actual setting (Alcantara, 1994). Lastly, VM has been described as more effective for rapid skill acquisition and generalization than live modeling (Allen, Wallace, Renes, Bowen, & Burke, 2010).

VP slightly differs from VM in that instead of an entire skill sequence being shown and subsequently practiced by the student, short segments or steps of the skill are broken up. The student is shown each step individually and, immediately after viewing each step, has an opportunity to practice and receive feedback on that step before moving on. VP interventions have successfully been used to teach students with developmental disabilities and ASD cooking-related skills (Graves, Collins, Schuster, & Kleinert, 2005; Mechling, Gast, & Fields, 2008; Mechling, Gast, & Seid, 2010) and self-help skills (Norman, Collins, & Schuster, 2001). Benefits of using VP as an instructional approach are similar to those cited for VM, with the additional benefit of presenting information in smaller steps. Researchers have speculated whether this instructional strategy is more appropriate to teach students with ASD a particular skill set (e.g., one that involves many steps or parts). As noted previously, minimal research has been done on using VP to teach daily living skills or comparing the efficacy of VM and VP interventions.

The purpose of this review is to discuss the results of interventions that implement VM and/or VP to teach individuals with ASD daily living skills. The review was restricted to studies conducted from 2005 to present to obtain more recent findings, taking into consideration published literature reviews on VM within the past 10 years. No literature reviews have been done up to this point in time that center on the use of VM and/or VP to teach daily living skills and no literature reviews have been published comparing the efficacy of both VM and VP to teach a specific skill set or domain area. Three primary research questions guided this review: (a) What methods/procedures are used in the development of videos (e.g., content of instruction, nature of the model, length of video, filming perspective, voiceover)? (b) What methods/procedures are used in the implementation of VM and VP interventions (e.g., technology device used to show video, intensity of intervention, antecedent prompting procedures, error correction strategies)? (c) What is the overall effectiveness of VM and/or VP to teach daily living skills to individuals with ASD?

Methods

Five inclusion criteria were required for studies to be incorporated in the review. First, studies used an experimental, quasi-experimental, or single-case research design and reported quantitative results. Second, study results were reported in a peer-reviewed journal. Third, studies with one or more participants with ASD were included in the review. Fourth, the independent variable manipulated in the studies involved the use of teacher-made or researcher-made (i.e., not commercially developed) video models and/or prompts designed to teach daily living skills (i.e., functional self-help or domestic skills). Fifth, the review included studies published after 2005. Several literature reviews (Delano, 2007; Hume et al., 2009; McCoy & Hermansen, 2007; Mechling, 2005) and a meta-analysis (Bellini & Akullian, 2007) were identified through the search process and studies identified in those reviews dating prior to 2005 were not reported in the current review, so as to not include additional overlap of information.

To identify studies for this review, ERIC, ProQuest, and PsycINFO electronic databases were searched using the following keywords: *(ASD OR developmental disability OR moderate disability OR severe disability) AND (activities of daily living OR functional skill OR daily living skill) AND (video model) OR (video prompt)* and all variations of these keywords. The search was restricted to English language peer-reviewed documents.

The search revealed 237 articles, 11 of which met inclusion criteria. An ancestral search of the articles also was conducted to identify additional articles meeting criteria. As a result of these procedures, two additional articles were identified bringing the total number of studies reviewed to 13 (Ayres & Langone, 2007; Cannella-Malone, Wheaton, Wu, Tullis, & Park, 2012; Cannella-Malone et al., 2006, 2011; Goodson, Sigafoos, O'Reilly, Canella, & Lancioni, 2007; Horn et al., 2008; Mechling, Gast, & Seid, 2009; Mechling & Gustafson, 2008; Murzynski & Bourret, 2007; Sigafoos et al., 2005, 2007; Van Laarhoven, Kraus, Karpman, Nizzi, & Valentino, 2010; Van Laarhoven & Van Laarhoven-Myers, 2006).

Results

In total, 13 studies were reviewed (see Tables 1 and 2). Participants (i.e., those that had a diagnosis on the ASD spectrum) ranged in age from 6 to 41 years old, and some of the 38 participants had concurrent disabilities of intellectual disability, behavior disorder,

Table 1
Study Characteristics and Intervention Development

Authors (year)	Participants (with ASD)	Design	Skills	VM or VP	Perspective	Length	Model type
Ayres and Langone (2007)	4 (ages 6–8)	adapted alternating treatments	putting away groceries	VM	first-person; third-person	not specified	POV; adult
Cannella-Malone et al. (2012)	1 (age 15)	adapted alternating treatment within a multiple prove across participants	sweeping; wiping a table	VP	third-person	3–26 s	adult
Cannella-Malone et al. (2011)	6 (ages 11–13)	multiple probe across participants with alternating treatments	doing laundry; washing dishes	both	first-person	VM: 2 min VP: 3–16 s	POV
Cannella-Malone et al. (2006)	4 (ages 27–41)	multiple probe across subjects design with alternating treatments design	setting a table; putting away groceries	both	first-person (VP); third-person (VM)	VM: 1 min 37 s and 2 min 42 s VP: 10–42 s (avg 15.45 s)	POV (VP); similar aged adult (VM)
Goodson et al. (2007)	3 (ages 33–36)	multiple baseline	setting a table	VP	third-person	9–13 s (avg. 10.5 s)	similar-aged adult
Horn et al. (2008)	2 (ages 25 and 29)	multiple baseline	doing laundry	VP	first-person	less than 20 s	POV
Mechling, Gast, and Seid (2009)	3 (ages 16–17)	multiple probe	cooking (microwave/ stove/toaster oven)	VP	third-person	not specified	adult
Mechling and Gustafson (2008)	6 (ages 15–21)	adapted alternating treatments	cooking-related tasks	VP	third-person	12–25 s	adult
Murzynski and Bourret (2007)	2 (ages 8 and 9)	parallel-treatment design; multiple baseline	Folding clothes; making a sandwich and juice	VM	third-person	18 s, 1 min 37 s, 21 s, and 1 min 24 s	adult
Sigafoos et al. (2007)	3 (ages 27–33)	delayed multiple probe	making popcorn in the microwave	VP	first-person	4–30 s (avg. 14 s)	POV
Sigafoos et al. (2005)	1 (age 36)	multiple baseline across subjects	washing dishes and storing them	VP	first-person	4–12 s (avg. 7.6 s)	POV
Van Laarhoven and Van Laarhoven-Myers (2006)	1 (age 18)	within-subject adapted alternating treatments design	cooking a microwave pizza; folding clothes; washing a table	both	first-person; third-person	not specified	zoom shots/POV; adult/full-view
Van Laarhoven et al. (2010)	2 (ages 13 and 14)	within-subject adapted alternating treatments design	cooking microwave pasta; folding laundry	VP	first-person; third-person	not specified	POV; adult

Table 2
Intervention Variables and Efficacy

Authors (year)	Independent variables	Dependent variables	Implementation	Treatment fidelity	Efficacy
Ayres and Langone (2007)	1. VM (1st person POV) 2. VM (3rd person POV) 3. Control	% of items attempted to store; % of errors; total time to reach mastery; total number of trials to reach mastery; total number of errors to reach mastery	Intensity: 1–2×/week Technology: computer	1/3 of all sessions; 100% pretest and posttest; 99.1% PC probes	no clear indication over 1st or 3rd person VM; all students progressed and met criterion on stimuli and control sets
Cannella-Malone et al. (2012)	1. VP without error correction 2. VP with error correction	percentage of steps completed correctly; percentage of steps requiring error correction; number of sessions required to reach criterion	Intensity: 3–8×/week Technology: iPod Touch	29% of sessions; mean of 99%	student met mastery criterion when VP with error correction was implemented; skill acquisition slightly more effective with error correction than without
Cannella-Malone et al. (2011)	1. VM 2. VP 3. Video prompt + error correction	% of steps correct (as per task analysis)	Intensity: 2–3×/week for 10–15 min Technology: notebook	19.4% (range 13–31%) of sessions; 100%	VP more effective than VM (not all achieved mastery though); VM - no effect with 5 of 7 students
Cannella-Malone et al. (2006)	1. Prompt vs. Model 2. Prompt all	% of steps correct (as per task analysis)	Intensity: 2×/week for 10 min Technology: minilaptop	None	VP more effective than VM; (in both tasks); VP shown to be generally effective in promoting acquisition and VM was ineffective
Goodson et al. (2007)	1. VP 2. VP + error correction	% of steps correct (as per task analysis)	Intensity: 2 days/week for 10–15 min Technology: minilaptop	None	VP + error correction more effective in skill acquisition
Horn et al. (2008)	1. VP 2. VP fade procedure	% of steps completed independently (as per task analysis)	Intensity: 3×/week Technology: laptop	99% across all sessions	1 participant acquired skill with first VP fade level (5 steps at a time); 1 student required written cue + individual step segments
Mechling, Gast, and Seid (2009)	1. PDA probe (picture only, picture + auditory, video prompt + voiceover)	% of steps performed independently correct; type of PDA prompt student used to perform steps	Intensity: 3–4×/week Technology: pocket PC (PDA)	25% of all sessions; mean reliability, 98.9%	immediate improvement in performance for all students across; students able to maintain their high levels of independent use of PDA and task completion over time
Mechling and Gustafson (2008)	1. Static pictures 2. VP 3. Final treatment condition (VP)	% of cooking-related tasks performed independently	Intensity: Technology: portable DVD player	20% of sessions; 99.7%	VP resulted in rapid improvement in task completion for all six participants; overall, VP resulted in higher percentage of correct task performance across all participants as opposed to static picture prompts during comparison phase

Table 2
(*continued*)

Authors (year)	Independent variables	Dependent variables	Implementation	Treatment fidelity	Efficacy
Murzynski and Bourret (2007)	1. Least-to-most prompting + VM 2. Least-to-most prompting only	number of steps completed independently for response chains	Intensity: 1–2 days/ week for 60–90 min Technology: TV/VCR	none	both participants acquired behavior chains with both methods but with fewer trials and fewer prompted steps with VM + L2M than L2M prompting alone
Sigafoos et al. (2007)	1. VP 2. Video prompt chunking (4 - chunk, 2 - chunk, 1 - chunk)	% of steps completed independently (as per task analysis)	Intensity: 2×/week for 10 min Technology: minilaptop	none	% of task analysis steps increased with VP; 2 of 3 individuals reached acquisition criterion and maintained % correct during follow-up
Sigafoos et al. (2005)	1. VP 2. VP fade/Video chunking	% of steps completed independently (as per task analysis)	Intensity: 2×/week for 6–8 min Technology: minilaptop	none	participant met acquisition criterion; immediate increases in percentage of steps correct when VP introduced; maintained high level of performance quickly; required prompt fading procedures
Van Laarhoven and Van Laarhoven-Myers (2006)	1. VM/rehearsal 2. VM/rehearsal + photos during task engagement 3. VM/rehearsal + video prompt during task engagement	% score for levels of assistance; % of independent correct responses; Number of prompts to use instructional materials; Number of session to reach criterion; % score for levels of assistance on measures of generalization; % of independent correct responses on measures of generalization	Intensity: not specified Technology: laptop	37% of all sessions; 100%	all instructional procedures effective in improving daily living skills; VM + VP appeared to be most effective in terms of independent responding during acquisition; VM + Photo was also effective and resulted in increased independent responding during acquisition
Van Laarhoven et al. (2010)	1. Picture prompts 2. VP	% of independent correct responses; % of error correction prompts; % of prompts to use technology; number of sessions to reach criterion; % of independent correct responses on measures of generalization; efficiency of interventions	Intensity: not specified Technology: laptop	28% across all sessions; 100%	both prompting systems effective at increasing independent correct responding for both students; VP appeared to be somewhat more effective and efficient across all dependent measures

Note. L2M = least-to-most prompting.

other health impairment, and hearing impairment. Interventions took place within a variety of environments including public schools, special education schools, residential/group homes, and vocational training centers.

Methods and/or Procedures for Development of Videos

Specific information on the types of skills taught in studies as well as the type of model used in the video can be obtained from Table 1.

Type of perspective incorporated

First-person (i.e., performer viewpoint, POV perspective, zoom) and third-person perspectives (i.e., spectator viewpoint, full view, adult model) were incorporated across studies with similar aged peer and adult models. POV perspective typically involves showing the hands of a model performing a given task; eight studies (Ayres & Langone, 2007; Cannella-Malone et al., 2006, 2011; Horn et al., 2008; Sigafoos et al., 2005, 2007; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006) used this type of model. Spectator viewpoint (e.g., viewing a model performing the task) was incorporated in eight studies (Cannella-Malone et al., 2006, 2012; Goodson et al., 2007; Mechling, Gast, et al., 2009; Mechling & Gustafson, 2008; Murzynski & Bourret, 2007; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006) through use of an adult model or model of similar age to the participants. Both VM and VP studies used POV more often than spectator viewpoint. Researchers in one study reported that no clear indications were observed with regard to using first and third person perspectives and intervention efficacy (Ayres & Langone, 2007). Others reported superiority in student performance when POV perspective was used as compared to spectator perspective (Cannella-Malone et al., 2006; Van Laarhoven et al., 2010).

Video length

Length of videos was reported in eight studies (Cannella-Malone et al., 2006, 2011, 2012; Goodson et al., 2007; Mechling & Gustafson, 2008; Murzynski & Bourret, 2007; Sigafoos et al., 2005, 2007). Video models ranged in length from 18 s (e.g., shirt folding) to 2 min 42 s (e.g., putting away groceries), whereas video prompt clips were reported to range in length from 4 to 30 s.

Voiceover instructions

Some investigators (Cannella-Malone et al., 2006, 2011; Van Laarhoven & Van Laarhoven-Myers, 2006) added a one-sentence voiceover to video models. This typically included verbal instructions for steps within the video. In two studies, VM was reported to have no effect or to be ineffective for most participants on skill acquisition. However, Van Laarhoven and Van Laarhoven-Myers (2006) found a VM plus VP instructional package (including the voiceover instruction) to be effective in increasing independent responding during acquisition. These researchers also reported that the VM plus photo package resulted in increased independent responding during acquisition.

Similarly, voiceover instruction was added to video clips in all but 1 (Horn et al., 2008) of the 11 VP studies. Unlike VM studies previously discussed, findings were generally positive for VP studies with regards to promoting student acquisition of daily living skills. Mechling, Gast, and Seid (2009) reported immediate improvement in performance for all students across all three recipes upon introduction of PDA to show VPs; skill maintenance was also achieved as well.

Methods and/or Procedures for Implementation of VM and/or VP

Instructional procedures

Instructional strategies varied slightly across studies such as the number of sessions conducted each week, the type of antecedent prompting used, and error correction procedures implemented. The intensity (i.e., frequency) of VM sessions was reported in four studies (Ayres & Langone, 2007; Cannella-Malone et al., 2006, 2011; Murzynski & Bourret, 2007). Intensity ranged from one to two times per day and between one and three times per week. Some researchers implemented instructional sessions for 10–15 min each session, whereas others reported weekly total time spent on instruction (lasting between 60 and 90 min). VP interventions were implemented between two and eight times per week (most often two) and lasted between 6 and 15 min per instructional session as reported in 8 of the 11 studies assessing efficacy of VP.

All studies contained some method of prompting when instruction was occurring, the most common being a verbal prompt to begin the task sequence. A system of least prompts (e.g., verbal, gesture, model, physical) was also utilized throughout many studies. When students would make an error or fail to complete a skill within a set time frame, Ayres and Langone (2007) terminated the instructional session (e.g., practice of skills viewed was done as a pretest/posttest instead of regular instruction because students viewed video clips or pictures and then "put them away" via a computer program). Researchers reported that all students in this study met set criteria for mastery on trials during VM instruction. In other studies, participants were guided through a least-to-most prompting hierarchy and when errors occurred were allowed to continue working through the steps.

In several VP studies, instructors provided students with picture prompts or a least-to-most prompting hierarchy if student errors persisted. When students made an error or failed to complete a skill within a set time frame, the teacher would most often complete the given step as unobtrusively as possible so that the student would have the opportunity to be presented with the following step in the sequence. In one study (Mechling et al., 2009), students were given the choice of one of three prompting methods (picture, picture + auditory, video + voiceover); if an error was made, the teacher would point to the next prompt level within the system of least prompts hierarchy. All participants showed immediate improvement in performance across all three recipes upon introduction of PDA; students were also able to maintain high levels of independent use of PDA and task completion over time. Van Laarhoven et al. (2010) also used a prompt hierarchy when student errors occurred, but students only were guided through a visual prompt followed by a gesture/physical prompt so the correct behavior would be practiced more quickly. Both participants were able to increase independent correct responding for with both picture and VP procedures; VP appeared to be somewhat more effective and efficient across all dependent measures. Cannella-Malone et al. (2011) implemented a prompting plus error correction phase in which they showed the video prompt a second time. If student errors continued, the researchers modeled the correct behavior and completed the step unobtrusively if needed. VP was reported by researchers to be more effective than VM; researchers also stated that not all students achieved mastery though. Lastly, Cannella-Malone et al. (2012) compared a VP without error correction procedure to VP with error correction. Error correction procedures consisted of interrupting the student's error and showing the video a second time. If errors persisted after this, a three-tiered least-to-most prompting hierarchy was initiated for that specific skill in the task sequence.

Effectiveness of VM and VP

VM interventions

Researchers in two studies (Ayres & Langone, 2007; Murzynski & Bourret, 2007) assessed the efficacy of VM interventions alone with dependent variables such as percentage of items attempted to store, percentage of errors, total time to reach mastery, total number of trials to reach mastery, total number of errors to reach mastery, and number of steps completed independently for response chains. When comparing first- and third-person VM perspectives to a control (i.e., no VM) for teaching elementary-aged participants to put away groceries through computer probes and in vivo pretest–posttest modeling, researchers (Ayres & Langone, 2007) reported no clear indication between the efficacy of over first- or third-person model conditions. Murzynski and Bourret (2007) suggested that elementary-aged participants acquired behavior chains while learning to fold clothes and make a sandwich and juice from an adult video model (i.e., third-person perspective or spectator perspective) with both methods implemented (i.e., VM plus least-to-most prompting and least-to-most prompting only phases); participants learned skills in fewer trials and fewer prompted steps with phases that added VM rather than phases with least-to-most prompting only.

VP interventions

As previously discussed, VP interventions were implemented in 11 studies reviewed. Dependent variables most often included measuring the percentage of steps performed independently correct; however, other researchers measured such variables as type of PDA prompt student used to perform steps, percentage of error correction prompts, percentage of prompts to use technology, and number of sessions to reach criterion. Researchers in one study (Van Laarhoven et al., 2010) also assessed efficiency of interventions (i.e., ratio of each participants growth to measured "cost" of minutes required to create materials) and reported that VP appeared to be somewhat more effective and efficient across all dependent measures.

Two studies reported efficacy measures of VP and fading or chunking procedures for teaching various daily living skills (Horn et al., 2008; Sigafoos et al., 2007). Horn et al. (2008) found that one participant learned how to do laundry with the use of VP alone; however, acquisition of the skill was evident in a video chunking phase when the task analysis and video clips shown were in two sets (e.g., each containing five steps); this performance was maintained 2 weeks later. The other participant had more difficulty learning the steps when instructed with larger "chunks" and only acquired the skills when shown individual step segments (e.g., one at a time instead of chunked) and provided a written cue instead of verbal cue to initiate a step.

Sigafoos et al. (2007) used a different fading process involving a three-level sequence (e.g., four chunks, then two chunks, then one video for the entire sequence). Investigators reported immediate increases in percentage of steps correct were observed when VP was introduced and all participants acquired high levels of performance quickly. However, researchers noticed that progress began to deteriorate when the second baseline phase was instituted and suggested that this may have been due to prompt dependency. As a result, prompt fading was used to help increase participant independence; results suggested that this procedure was effective at maintaining task performance at levels of 80–100% for all participants and then during a withdrawal to baseline for two of the three students.

Efficacy of VP as compared to static picture prompting interventions was reported in three studies. Mechling and Gustafson (2008) and Van Laarhoven et al. (2010) suggested that VP was more effective than static pictures in prompting task completion of cooking-related skills and folding laundry. Increases in performance were seen for both forms of prompting (i.e., static picture prompts and VP) as each phase began but performance for static pictures remained low throughout the phase for three of the six participants (Mechling & Gustafson, 2008). However, VP resulted in rapid improvement in task completion for all six participants. Overall, use of VP resulted in a higher percentage of correct performance across all participants compared to static picture prompts. Due to its suggested effectiveness, researchers implemented VP alone in the final treatment phase; all students maintained or improved their performance on the cooking-related tasks. In the other study (Van Laarhoven et al., 2010), researchers stated that VP and picture prompting systems were effective at increasing independent correct responding for both students but that VP was slightly more effective and efficient across all dependent measures (e.g., highest percentage of independent correct responding, fewer external prompts, and fewer technology prompts for both students). Lastly, Mechling, Gast, and Seid (2009) had high school students use a PDA to view VP when learning cooking-related skills. Visual inspection of data and a reported 100% percentage of non-overlapping data (PND) indicated immediate improvement in performance for all students across three recipes on introduction of VP via the PDA. Students also were able to maintain high levels of independent use of PDA and task completion over time.

Additionally, researchers in three studies assessed the efficacy of VP when used by itself or with the addition of an error correction procedure. Sigafoos and colleagues (2005) reported that the percentage of task analysis steps increased with VP as compared to baseline (i.e., no prompting) phases for the participant; acquisition criterion was reached as well and skills were maintained during follow-up probes. Goodson et al. (2007) reported that only one of the three participants learned table setting when VP alone was used as the antecedent prompt without error correction procedures. When error correction was added to VP, all participants acquired skills of setting a table by performing 100% on the task analysis. Participants also maintained skills following acquisition. Lastly, when comparing VP without and with error correction procedures, Cannella-Malone et al. (2012) reported that skill acquisition was more efficient when error correction procedures were used from the onset of instruction.

Comparative studies

Researchers in three studies compared the effectiveness of VM and VP interventions to teach various daily living skills to individuals with ASD. When VM and VP intervention efficacy was compared when teaching six participants with ASD and moderate intellectual disabilities to do laundry and wash dishes, researchers (Cannella-Malone et al., 2011) reported that VP was more effective than VM. Although not all participants achieved mastery with VP, VM was suggested to have no effect for five of the six students. Cannella-Malone and colleagues (2006) also suggested that VP was more effective than VM procedures for teaching four adults how to set a table and put away groceries. Researchers in this study concluded that VP was shown to be generally effective in promoting acquisition and that VM was ineffective (i.e., participants were showing little to no improvement in percentage of steps performed correctly).

Researchers in one final study (Van Laarhoven & Van Laarhoven-Myers, 2006), compared an 18-year-old student's performance of completing task analyses for three different VM sequences (e.g., VM/rehearsal only, VM/rehearsal + photo prompts during task sequence, and VM + VP during task sequence) when cooking a microwave pizza, folding clothes, and washing a table. Authors suggested that all instructional procedures were effective in improving daily living skills and that the video/in vivo (i.e., VM + VP) appeared to be most effective for independent responding during acquisition. The VM plus photo prompt sequence also was found to be more effective than VM alone, resulting in increased independent responding during acquisition.

Treatment fidelity

Treatment fidelity was reported in three of the five VM studies (Ayres & Langone, 2007; Cannella-Malone et al., 2011; Van Laarhoven & Van Laarhoven-Myers, 2006) and in 7 of 11 VP studies reviewed (Cannella-Malone et al., 2011, 2012; Horn et al., 2008; Mechling et al., 2009; Mechling & Gustafson, 2008; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). Mechling and Gustafson (2008) assessed the procedural reliability of several teacher behaviors used to implement the static picture prompting and VP methods in their study. These behaviors included: presenting the static picture and delivering task instruction, turning on DVD player and delivering task instruction, having all materials prepared, waiting 3 s for task initiation, waiting 1 min for task completion, no delivery of prompts or cues, and delivery of reinforcement. A mean procedural agreement was reported as 99.7%; VP resulted in rapid improvement in task completion for all six participants and resulted in higher percentage of correct task performance as opposed to static picture prompts. Researchers in another VM study had a second observer collect treatment fidelity data to ensure that the correct condition was being applied, if order of tasks was presented as stated in research protocol, and whether the prompting hierarchy was delivered as intended; all instructional procedures were reported as being effective in improving daily living skills aimed at increasing independent correct responding (Van Laarhoven & Van Laarhoven-Myers, 2006).

Generalization and maintenance

Researchers in three studies (Ayres & Langone, 2007; Cannella-Malone et al., 2006; Van Laarhoven & Van Laarhoven-Myers, 2006) assessed generalization of skills learned in novel environments. Maintenance probes (i.e., follow-up probes) were conducted in seven studies (Horn et al., 2008; Mechling et al., 2009; Mechling & Gustafson, 2008; Sigafoos et al., 2005, 2007; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). Overall, participants showed varied performance when generalization probes were conducted and were able to maintain levels of performance when assessed anywhere from one week to 12 weeks post instruction.

Quality of studies

Quality of the studies was evaluated by the authors using Horner et al.'s (2005) criteria. See Table 3 for details regarding the number of studies meeting each of the criteria. Results indicated that individual studies met on average 80% (range of 52–95%) of the quality indicators for single subject research. Sixty-two percent of studies included procedural fidelity measures, and only 23% included measures of social importance, although all studies were designed with the intention of improving a socially important dependent variable. In eight (62%) studies, researchers measured whether the independent variable was implemented over time, by typical intervention agents, or in typical social or physical contexts. Lastly, in two studies researchers reported practicality and cost effectiveness of interventions.

Discussion

As reported in the studies reviewed, VM and prompting interventions have been successful at teaching individuals with ASD a variety of daily living skills. Several important points can be made regarding effective instruction with VM and prompting when teaching daily living skills. Some areas that warrant further discussion include (a) the efficacy of VP versus VM interventions to teach daily living skills, (b) instructional features that may impact the success of students (e.g., filming perspective, voiceover instruction, mode of delivery), and (c) the role that fading procedures play within interventions.

VM and Prompting Efficacy

Based on the results of the studies reviewed, VP can be an effective instructional method for acquisition of daily living skills for students with ASD. Researchers reported similar positive gains in correct completion of steps learned for target skills across studies implementing VP interventions as well as for those that compared VP to VM. It can also be suggested that VM interventions have been somewhat effective overall at promoting acquisition of daily living skills.

Bandura (1977) noted that the overall efficacy of rate and level of observational learning is influenced by both the complexity of the model and one's ability to pick out salient features of the behavior. VM and prompting interventions are designed to highlight the most salient features of a given skill through the use of visually based instruction. This type of instruction can assist individuals with ASD to pick out the key components of a target skill and therefore promote skill acquisition.

One might wonder, what role does the actual video play in acquiring daily living skills when compared with other forms of instruction provided by an adult (e.g., in vivo modeling) or through use of picture prompts? As previously discussed, least-to-most prompting in addition to least-to-most prompting plus VM were both found to be effective in promoting skill acquisition by Murzynski and Bourret (2007), although authors noted that skills were learned more quickly and with fewer prompts

Table 3
Horner's Quality Indicators Met Within Studies Reviewed

	Quality indicators for single subject research	Number of studies meeting criteria (out of 13 total)
Participants	Sufficiently described	12
	Selection described efficiently	11
	Setting described sufficiently	12
Dependent variable (DV)	Described with replicable precision	13
	Quantifiable	13
	Measurement described to replicable precision	13
	Measurement occurred repeatedly	13
	Interobserver agreement data reported	13
Independent variable (IV)	Described with replicable precision	11
	Systematically manipulated	13
	Procedural fidelity described	8
	Content validity defined	13
Baseline	Phase provided evidence of predictable pattern, prior to intervention	6
	Described with replicable precision	11
Validity	Three demonstrations of experimental effect	9
	Design controlled threats to internal validity	9
	Effects replicated, indicate external validity	10
	DV socially important	13
	Magnitude of change in DV due to intervention socially important (social validity)	3
	IV is cost effective/practical (described by authors)	2
	IV is implemented over time, typical contexts/typical agents	8

Table adapted from Test, Richter, Knight, and Spooner (2011).

needed with the VM intervention. In addition, researchers in three studies reviewed reported VP having stronger effects overall than picture prompting on student performance. Although modeling in general has been reported to be an "established" evidence-based practice (NAC, 2009), certain types of modeling may be more effective at further enhancing skill acquisition, perhaps even depending on the skill of focus. Similar findings have been shared by Charlop-Christy et al. (2000) where VM was reported as resulting in faster acquisition of various task, including self-help skills, and generalization when compared to in vivo. VM and prompting may provide students with instruction that is more consistent and focused on the exact characteristics of the target behavior rather than a live model would provide. Some other hypotheses cited in the research point to VM limiting overselectivity for students with ASD by focusing on the most relevant features of the skill to be performed, videos may be intrinsically reinforcing for students with ASD, and lastly video-based instruction may be more stimulating as it provides students with a change from the typical format of instruction (Charlop-Christy et al., 2000).

Most skills in the daily living domain are comprised of multistep or chained behaviors. Given that VM and VP often employ multistep behaviors, it seems highly appropriate that such skills be taught via VM and VP techniques. Specifically, during VM and VP instruction, skills are broken into discrete steps through task analysis procedures. Using VM or VP enables students to visually learn the entire task sequence, whether these steps are shown in a continuous manner (such as in VM) or one step at a time until the process is complete (such as with VP). Because both methods can be effective, a valid question to ask then might be whether one method of instruction is more effective than the other.

Three studies reviewed tried to provide a possible answer to this question (Cannella-Malone et al., 2006, 2011; Van Laarhoven & Van Laarhoven-Myers, 2006). These authors found that VP was more effective than VM alone, with researchers in two of the studies reporting that VM had little to no effect on student performance. Cannella-Malone et al. (2011) found that VP was more effective during skill acquisition for students with ASD, with several possible explanations cited by the researchers including the assertion that impairment in the attention span of students with ASD is better addressed by showing short video clips of individual segments (e.g., VP) rather than showing an entire skill segment after which the student is expected to perform all of the component steps of the skill. It has been reported that individuals with ASD acquire novel information more efficiently when there are limited demands placed on attention and memory (Travers et al., 2011). As noted previously, length of video models in studies lasted as long as 2 min and 42 s, whereas VPs were reported to last from 3 to 42 s. Given limited attention span and memory of individuals with ASD, the short duration of the VP may be one possible explanation for their stronger efficacy. Additional research investigating the effectiveness of these two methods through high-quality research designs would continue to benefit this research field.

As previously noted, treatment fidelity was assessed and reported in 8 of 13 studies (Ayres & Langone, 2007; Cannella-Malone et al., 2011; Horn et al., 2008; Mechling et al., 2009; Mechling & Gustafson, 2008; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). This is similar to the findings of a recent meta-analysis of VM and video self-modeling interventions for students with ASD in which treatment fidelity was reported in less than half (i.e., 9 of 25) of the studies reviewed (Bellini & Akullian, 2007). It is important to recognize that simply because a study does not report treatment fidelity does not automatically make it an ineffective study (Bellini & Akullian, 2007). However, fidelity can provide other researchers with necessary replication data (e.g., whether the intervention was conducted as intended and the procedures identified). This information also can be of use to practitioners when they are creating and implementing VM or VP. Clear procedures can act as a guide for instruction and can be useful for educators who have limited experience integrating technology into their teaching. Future research in VM and VP should include assessment of treatment fidelity and well-defined protocols for implementation of procedures.

Instructional Features

Given that individuals with ASD often have poor attention skill and a tendency to attend to irrelevant details of a task (Travers et al., 2011), directing an individual's attention to the critical feature(s) of a given task may be beneficial to target critical information needed to perform the skill. One method used to direct attention to the task frequently used in this review was POV modeling. POV or first-person perspective was used by most researchers (Ayres & Langone, 2007; Cannella-Malone et al., 2006, 2011; Horn et al., 2008; Sigafoos et al., 2005, 2007; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). Ayres and Langone (2007) suggest that POV perspective is useful to teach functional skills because participants can see exactly what they would be doing when performing the actual skill. Based on the research literature, using POV to teach daily living skills appears to incorporate instructional components that are useful to lessen poor attention and other skill deficits displayed by individuals with ASD.

Ten studies reviewed added a component of voiceover instruction to the video models or prompts (Cannella-Malone et al., 2006, 2011, 2012; Goodson et al., 2007; Mechling et al., 2009; Mechling & Gustafson, 2008; Sigafoos et al., 2005, 2007; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006).

Voiceover instruction typically involved adding a one-sentence verbal description of the step being shown occurring simultaneously with the visual image. When verbal directions are paired with visual cues or materials, this better enables individuals with ASD to grasp meaning from content, especially for individuals who have difficulty processing information only given to them in a verbal manner (Ganz, Bourgeois, Flores, & Campos, 2008). These instructions may not only direct the student's attention as to what behavior is currently occurring but also may keep their attention focused on the video. Over time with repeated practice using the VM or VP, students may memorize the sequence of these simple sentences to help them in the future when they perform the skill. This may also be an interesting variable to manipulate in future research as it is often included within the VM or VP intervention "package."

Conveying the material in an efficient and engaging format is also an important component to consider when considering what may impact the efficacy of a VM or VP intervention. Using peripheral devices (e.g., portable DVD players, laptops, iPods, iPads, etc.) can be an effective means to present material to individuals in a convenient and socially valid manner. These devices often are easy to obtain, user friendly, and relatively low in cost when considering the amount of use they can provide. VM and prompting shown through such technologies have been used to teach other populations of individuals with disabilities such as students with developmental and intellectual disabilities (Cihak, Fahrenkrog, Ayres, & Smith, 2010; Mechling et al., 2008, 2010; Mechling & Savidge, 2011). Researchers have used devices such as portable DVD players and PDAs to teach cooking skills to individuals with moderate intellectual disabilities through VP as well as iPods and PDAs for teaching transitional behaviors to students with ASD. Cannella-Malone et al. (2012) used an iPod Touch to teach an adolescent male with a moderate intellectual disability and ASD how to sweep and wipe a table through VP and error correction procedures. One key strength of incorporating a portable technology device, especially those that contains a self-operated prompting system (such as is possible via a PDA), is that the device can not only increase a student's independence and confidence in performing a task but also decrease the frequency of external prompting by others (Mechling & Savidge, 2011). Thus, not only could technology be effective for VM and VP, but it also can be viewed as a socially valid instructional delivery system.

Additionally, scholars in the field of special education have discussed how specific, immediate feedback should be provided to individuals for each successful step completion of the task, as this remains one of the characteristics of effective, explicit instruction (Archer & Hughes, 2010; Rosenshine, 1987). This can be done through systematic error correction and reinforcement procedures. Error correction procedures may differ depending on what type of instructional (VM or VP) technique is used. Regardless of format chosen, student errors should be interrupted immediately so that students are not practicing errors and subsequently are given specific feedback (Archer & Hughes, 2010). Researchers have suggested that some individuals with more significant disabilities may require longer periods of time to learn new skills; teaching new skills correctly from the start would be most beneficial to a student so they do not have to unlearn errors later (Cannella-Malone et al., 2012). In some cases (i.e., Horn et al., 2008), if a student made an error the interventionist would complete the specific step unobtrusively so that the student would have the chance to complete the next step in the sequence (e.g., the step completed in error was the discriminative stimulus for the following step). Least-to-most prompting was also utilized in studies reviewed. In two studies (Cannella-Malone et al., 2011; Goodson et al., 2007), researchers showed the video model a second time if the participant made an error and then modeled the skill in vivo if the step was still not completed correctly. Cannella-Malone and colleagues (2012) implemented another level to their error correction procedure wherein, if students did not perform a step correctly after a second viewing of the video, a three-step prompt hierarchy was initiated for that skill step. If student performance plateaued or declined from there, in vivo instruction with a most to least prompting procedure was implemented. These researchers pointed out that error correction procedures helped strengthen the stimulus control of the video prompt to promote correct responding by students in addition to providing students feedback about their accuracy so they were not practicing errors from the start (Cannella-Malone et al., 2012). In general, error correction methods should be implemented immediately and consistently, providing individuals with meaningful feedback throughout instruction to promote skill acquisition.

Additionally, when designing an instructional sequence using VM or VP, consideration should be given to delivery of reinforcement procedures. However, Horn and colleagues (2008) discussed their rationale for providing reinforcement after only the 3rd, 6th, and 10th steps completed as needed to rule out positive reinforcement as a variable leading to skill acquisition. Most researchers provided nonspecific reinforcement on a ratio schedule. In some studies, participants were given the opportunity to consume a snack or beverage they made. In future research, it would be useful to measure the effect of various reinforcement techniques such as providing specific positive feedback on skill acquisition during VM and VP interventions.

Prompt Fading

One final discussion point raises the question as to whether video prompts need to be faded over time to decrease the likelihood of prompt dependence for individuals with ASD. Research has suggested that individuals with ASD may experience difficulty acquiring response chains and that strategies such as least-to-most prompting and modeling can be useful to teach behavioral chains (Murzynski & Bourret, 2007). Then as they begin to acquire and develop fluency, fading procedures can be implemented to avoid prompt dependence. Only one study reviewed (Sigafoos et al., 2007) addressed this issue. When teaching new skills to students, one ultimate goal as educators should be to ensure that students will be able to perform the behavior in the future as independently (and accurately) as possible. For many learners performing daily living skills in their future home settings, they may not have the resources and support available to them to use the technologies described throughout this review. For example, it may not be possible or practical for a 35-year-old man with ASD living in a group home to always have a VM available to him when he washes the dishes. Ideally, we would want this individual to be able to perform the behavior with as few prompts as necessary.

Sigafoos and colleagues (2007) highlight how important it is to maximize student independence by limiting the amount of prompts (i.e., prompt dependency). Gradual fading of prompts also has been suggested to increase the likelihood of maintaining progress rather than abrupt withdrawal of the intervention (MacDuff, Krantz, & McClannahan, 2001). In one study (Sigafoos et al., 2007), researchers combined VP segments until an entire sequence (essentially a video model) was created so that students were not dependent on step by step prompting to complete a skill. These researchers stated that task performance was maintained at 80–100% correct after implementation of this chunking procedure. Two of the three students maintained progress, while the third student was found to need the 1-chunk or whole video sequence prompt to maximize his task performance. This novel prompt fading process warrants future research.

Conclusion

Individuals with ASD must be provided with instruction that addresses both their strengths and weaknesses. One particular area of strength for individuals with ASD is visual processing (Arthur-Kelly et al., 2009; Cihak, 2011; McCoy & Hermansen, 2007; Quill, 1997; Schlosser & Blischak, 2001). VM and prompting interventions have been used for students with ASD to teach a variety of skills including skills needed for daily living. The findings of studies reviewed related to teaching daily living skills to individuals with ASD suggest that VP can be an effective instructional tool for this purpose and VM has been reported to be somewhat effective overall. Future research must address the effect that various components of the interventions have on student performance (e.g., model type, length of video, method of viewing the video, filming perspective, error correction, prompt fading, voiceover instruction). Teaching individuals valuable life skills through technology-enhanced methods can have an immediate positive effect on skill acquisition.

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