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Effects of Video Prompting Techniques on Teaching Daily Living Skills to Children With Autism Spectrum Disorders: A Review

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Abstract

Video-based instruction is becoming a common intervention in today's classrooms. Previous research has focused primarily on video modeling techniques that required the student to watch an entire video of the task before attempting to complete the task independently. Video prompting is a form of video instruction that breaks down target skills into steps that are then performed directly after viewing each clip. The present review examined studies using video prompting techniques to teach functional and daily living skills to individuals with autism spectrum disorders (ASD). The focus of the review was on evaluation of the effectiveness of video prompting and the factors that affect student attention to the video, retention of target behavior, production of target behavior, and motivation. Results showed that video prompting was an effective intervention for teaching a wide array of target skills and that students with ASD were able to generalize and maintain the acquired skills. Video prompting was also shown to be more effective than both static picture prompts and video modeling techniques in terms of percentage of correct independent responding. Suggestions for practice and future research are discussed.

Keywords

autism, technology, video-based instruction, video prompting, daily living skills

The most recent report published by the Centers for Disease Control and Prevention (2014), states that 1 in every 68 children has been diagnosed with autism spectrum disorders (ASD). Autism is a neurodevelopmental disorder that is often characterized by social impairments, communication delays, and non-typical behaviors such as repetitive motor movements or strong attachment to routines (Volkmar & Pauls, 2003). Delays in these areas often lead to lower academic performance, maladaptive behavioral issues, and deficits in functional living skills (Gillham, Carter, Volkmar, & Sparrow, 2000). Given such high incidence rates, many families will deal with the daily challenges of having a family member with ASD.

Acquisition of independent living skills is a primary concern for parents and families of individuals with ASD (Heiman, 2002). Many individuals with developmental disabilities, including ASD, display deficits in the daily living skills required for independence (Jacobson & Ackerman, 1990; Kraijer, 2000). Daily living skills include, among others, self-care skills (e.g., dressing), hygiene (e.g., brushing teeth), household chores (e.g., mopping), cooking, and community living skills (e.g., grocery shopping). Failure to teach these skills can lead to learned helplessness, poor self-esteem, and overall low quality of life (Curtis, 1989; Hayden, 1997; Parmenter, 1994). Although identifying best practices to teach daily living skills to

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individuals with ASD is of utmost importance, teachers have stated that identifying such practices is overwhelming (Simpson, 2005).

Video modeling has been identified as an established, evidence-based intervention to teach personal responsibility skills to individuals with ASD by the National Autism Center (Wilczynski et al., 2009). Video modeling involves creating a video of someone performing a target skill. The video is then shown to the student and the student is asked to perform the behavior (Cannella-Malone et al., 2006). Video modeling has been used to teach such skills as conversation (Sherer et al., 2001), vocational (Van Laarhoven, Johnson, Van Laarhoven-Myers, Grider, & Grider, 2009), play (D'Ateno, Mangiapanello, & Taylor, 2003), and daily living (Graves, Collins, Schuster, & Kleinert, 2005). Charlop-Christy, Le, and Freeman (2000) conducted a study comparing video modeling with in vivo instruction (live model) to teach developmental skills (e.g., independent play, conversational speech) to children with ASD. Results showed that the video modeling condition led to faster acquisition and generalization of the target skills than the in vivo modeling condition.

Video modeling to teach target behaviors can be viewed through the framework of social learning theory (SLT) whereby individuals learn by observing, imitating, and modeling others (Bandura, 1977). Bandura postulates that there are four necessary elements needed for successful modeling: attention, retention, reproduction, and motivation. Student attention refers to various factors that contribute to a student's ability to focus. Retention refers to the process of remembering the steps in a task and performing those steps independently. Reproduction occurs when a student performs the skill. In the context of this review, reproduction also refers to a student's ability to generalize the skill to another setting, task, or set of materials. Motivation refers to the individual's desire to perform the task. Bandura also states that the model of the video is an important factor in imitation, stating that the most effective models are similar to the students in terms of gender, age, and ability level. Thus, according to SLT, students will be more likely to attend to a video where the model was similar to themselves or if the student themselves modeled the behavior.

Video modeling and other types of video-based instruction provide many benefits to both the instructor and the learner. For the instructor, video-based instruction allows more consistent and precise teaching methods to occur (Ayres & Langone, 2005). As classroom sizes continue to expand, the ability to provide direct instruction by video is not only effective but also efficient in terms of instructional time required. Teachers can use video modeling with classroom instructional assistants and substitute teachers to ensure that students are receiving the same model. Some studies have examined student-controlled video instruction (Mechling, Gast, & Seid, 2009; Van Laarhoven, Kraus, Karpman, Nizzi, & Valentino, 2010), wherein the student starts and stops the video and can replay the video as necessary. Student-controlled instruction permits the teacher more time to focus on other demands while giving the student a sense of autonomy. Another benefit of video-based instruction is portability. With advancements in today's technology, instruction is possible in students' homes, workplace, grocery stores, community parks, and so on (Van Laarhoven & Van Laarhoven-Myers, 2006).

Although there are several benefits of video modeling for students with ASD, one limitation is well-documented memory impairments (Matson & Smiroldo, 1999; Quill, 1997). Specifically, video modeling requires the student to watch the entire skill being performed, which can be several minutes in length (Cannella-Malone et al., 2006). Video prompting is a form of video modeling in which the task is broken into discrete steps on the video rather than showing the target skill presented in its entirety. Participants watch clips on the video depicting the task sequence that is typically less than 30 s in length and are then asked to perform that step before the next step is viewed (Cannella-Malone et al., 2006). Although video prompting is a form of video modeling in the broad sense that instruction is being delivered via videos, researchers in the field have used the terms "video modeling" and "basic video modeling" to refer to the presentation of the entire task at once, and the term "video prompting" for presentation of the task in short segments (Wong et al., 2013). This article will also use the terms in that way, consistent with the 12 studies included in the review.

The short segments presented in video prompting incorporate the procedure of response chaining, wherein complex tasks are broken into attainable units (O'Donohue & Fisher, 2009). The goal is for the student to perform skills in the chain of tasks independently at the end of instruction. The literature on

response chaining suggests that video prompting leads to a more rapid acquisition of skills than video modeling techniques (Duker, Didden, & Sigafoos, 2004), because students are being asked to process smaller amounts of information all at once. Video prompting is a promising instructional technique for individuals with ASD due to their deficits in short-term working memory (Poirier, Martin, Gaigg, & Bowler, 2011; Williams, Goldstein, Carpenter, & Minshew, 2005) and these deficits become more apparent as tasks become more complex (Minshew & Goldstein, 2001). When information is presented to students in small amounts, it can be processed more effectively and efficiently (Minshew & Williams, 2008). Video prompting allows students to gradually attain the steps required to perform the desired skill while gaining confidence regarding their performance (Cihak & Schrader, 2008). Although promising, there is a lack of research related to video prompting for individuals with ASD (Rayner, Denholm, & Sigafoos, 2009).

The purpose of this review was to determine the effectiveness of video prompting for teaching daily living skills to individuals with ASD. In addition, other research questions were developed using essential elements of SLT. Review questions included examining factors that may affect student

1. attention to the video
2. retention (performance) of target behavior
3. reproduction (generalization) of target behavior
4. motivation (maintenance of target behavior)

Method

The focus of this literature review centered on video prompting techniques. A systematic electronic search of the Educational Research Information Center (ERIC), PsychINFO, PsychARTICLES, and ProQuest databases was conducted. Combinations of the following keywords were used in the search: video prompting, video instruction prompting, daily living skills, functional living skills, autism, and ASD. These terms were found as keywords for many of the articles that were reviewed. The original search resulted in six studies. One study was excluded because the authors used video modeling rather than video prompting techniques. An ancestral search of the resulting articles was conducted to find additional studies that were relevant to the review; three additional studies were located. Finally, on discussion with colleagues and researchers in the field, additional six studies were identified. Two of these studies were excluded from the review because the participants were not diagnosed as having autism, but rather described as having "mild autism traits." A time frame of 2005-2013 was selected for this review of the literature based on a previous review of video instruction conducted in 2005 (Ayres & Langone, 2005). Banda, Dogoe, and Matuszny (2011) also conducted a review of the literature on video prompting. This review expands their findings by including several studies and also aims to focus specifically on individuals with autism rather than the broad category of "developmental disabilities."

Articles included in this review met specific inclusion and exclusion criteria. First, the articles were published in a peer-reviewed journal. Second, to be included in the review, at least one participant in the study had to be identified as having ASD. Finally, the intervention had to target functional living skills (e.g., grooming, daily chores, cooking). A total of 12 articles met inclusion criteria. Information about the studies, including participants, experimental design, video perspective, settings, target skills, and results are included in Table 1. Due to the complexity of the comparison studies included in this review, detailed information regarding the independent and dependent variables can be found in Table 2.

Results

Participants

Results and data provided only include the participants in the studies who were diagnosed with ASD. There were a total of 38 individuals in the 12 studies that met the inclusion criteria. Three of these individuals were female. Participants in 9 of the studies also were diagnosed as having mild or moderate intellectual

Table 1. Summary of Studies on VP and Daily Living Skills.

Author(s)	Participants	Research design	VP point of view	Settings	Target skills	
Bereznak, Ayres, Mechling, and Alexander (2012)	*N* = 3 ASD (3M) (ages 15-18)	Multiple-probe design across behaviors replicated across participants	Performer	School living center and teacher workroom	• Using a washing machine • Making noodles • Using a copy machine	• Improved performance using VP
Cannella-Malone et al. (2006)	*N* = 6 ASD (5M, 1F) (ages 27-41)	Multiple-probe across subjects with an adapted alternating treatments design	Performer	Vocational room in residential group home	• Set a table • Put away groceries	• VP had + gains • VM was generally ineffective
Cannella-Malone et al. (2011)	*N* = 6 ASD (4M, 2F) (ages 11-13)	Multiple-probe across subjects with an alternating treatments design	Performer	Home-like setting in school	• Doing laundry • Washing dishes	• Overall VP was + • VM was generally ineffective • 3 students required in vivo instruction
Cannella-Malone, Wheaton, Wu, Tullis, and Park (2012)	*N* = 1 ASD (1M) (age 15)	Adapted alternating treatments design within a multiple-probe across participants	Spectator	Urban self-contained school	• Sweeping • Table washing	• Increase with VP • Steeper gains with VP + error correction
Goodson et al. (2007)	*N* = 3 ASD (3M) (ages 33-36)	Multiple baseline across subjects	Spectator	Vocational Training Center	• Table setting	• Improved performance using VP • Criterion reached after error correction
Mechling and Gustafson (2008)	*N* = 6 ASD (6M) (ages 15-21)	Adapted alternating treatments design	Spectator	Home-like setting in school	• Cooking-related tasks	• Greater number of tasks completed using VP • PP effective but to a lesser degree than VP
Mechling, Gast, and Seid (2009)	*N* = 3 ASD (3M) (ages 16-17)	Multiple-probe across skills	Spectator	Home-like setting in school	Cooking-related tasks	Improved performance using VP
Rayner (2011)	*N* = 3 ASD (3M) (ages 9-10)	Multiple baseline across subjects and an alternating treatments design	Performer (with opening and closing as spectator)	School	Shoe Tying	Improved performance using VP for 2 of 3 participants
Sigafoos et al. (2005)	*N* = 1 ASD (1M) (age 36)	Delayed multiple probe	Performer	Vocational room in residential group home	Microwave oven use	Participants acquired skills
Sigafoos et al. (2007)	*N* = 3 ASD (3M) (ages 27-33)	Multiple baseline across subjects	Performer	Vocational room in residential group home	Wash dishes	• All acquired skill with VP • 2 of 3 participants continued high performance after VC
Van Laarhoven and Van Laarhoven-Myers (2006)	*N* = 1 ASD (1M) (age 18)	Adapted alternating treatments design	Combination of performer and spectator	Teacher faculty lounge	• Cooking pizza • Folding clothes • Washing a table	• All interventions effective • VM with VP resulted in most independent responding
Van Laarhoven, Kraus, Karpman, Nizzi, and Valentino (2010)	*N* = 2 ASD (2M) (ages 13-14)	Adapted alternating treatments design	Combination of performer and spectator	Classroom	• Cooking pasta • Folding clothes	• Both interventions were effective • VP was more effective in terms of independent correct responding

Note. VP = video prompting; ASD = autism spectrum disorder; VM = video modeling; PP = picture prompts; VC = video chunking.

Table 2. Summary of Independent and Dependent Variables.

Author(s)	Independent variable	Dependent variable	Results
		VP studies	
Bereznak, Ayres, Mechling, and Alexander (2012)	Student-controlled VP	Number of steps performed independently	• Increased number of correct responses • 2 of 3 students were able to self-prompt
Cannella-Malone, Wheaton, Wu, Tullis, and Park (2012)	Instructor-controlled VP	• % of correct responses • % steps requiring error correction • Number of sessions required to reach criterion	• Increased number of correct responses • Steeper gains with VP + error correction • Did not meet criterion for 1 skill with VP and error correction
Goodson, Sigafoos, O'Reilly, Cannella, and Lancioni (2007)	Instructor-controlled VP	% of steps in task completed correctly	• One increased with on VP • Others increased with VP + error correction
Rayner (2011)	Instructor-controlled VP	% of steps in task completed correctly	• No participants reached mastery with VP alone • 2 increased with VP
Sigafoos et al. (2005)	Instructor-controlled VP	% of correct responses	• Increased % of correct responses within 5 sessions
Sigafoos et al. (2007)	• Instructor-controlled VP • Instructor-controlled VC	• % of correct responses • % of independent steps	• Increased % of correct responses within 10 sessions
		VP compared with static PP	
Mechling and Gustafson (2008)	• Instructor-controlled VP • Instructor-controlled PP	% of correct responses	• Higher % of correct responses with VP condition (78.2) than the PP condition (39.2)
Van Laarhoven, Kraus, Karpman, Nizzi, and Valentino (2010)	• Instructor-controlled VP • Instructor-controlled PP	• % of correct responses • number of external prompts • efficiency • number of error correction procedures • number of sessions to criteria	• Higher % of correct responses with VP condition • Fewer external prompts required for VP • VP found to be more efficient • VP had lower % of errors • VP required the same number of sessions to meet criteria as picture prompting
Mechling, Gast, and Seid (2009)	• Student-controlled VP • Student-controlled PP	• % of correct responses • % of prompt levels	• Higher % of correct responses with VP condition • Student selected VP condition the most
		VP compared with VM	
Cannella-Malone et al. (2006)	• Instructor-controlled VP • Instructor-controlled VM	% of correct responses	Higher % of correct responses with VP condition
Cannella-Malone et al. (2011)	• Instructor-controlled VP • Instructor-controlled VM	% of correct responses	• Higher % of correct responses with VP condition
Van Laarhoven and Van Laarhoven-Myers (2006)	• Instructor-controlled VM • Instructor-controlled VM with PP • Instructor-controlled VM with VP	• % of correct responses • % score for levels of assistance • number of prompts to use technology • number of sessions to criteria	• Higher % of correct responses with VP • More independence on levels of assistance with VP • More external prompts required to use VP • Same number of sessions to criteria as PP condition • Fewer number of sessions to criteria than the VM condition

Note. VM = video modeling; VP = video prompting; VC = video chunking; PP = picture prompts.

disabilities (Cannella-Malone et al., 2006; Goodson, Sigafoos, O'Reilly, Cannella, & Lancioni, 2007; Mechling et al., 2009; Mechling & Gustafson, 2008; Rayner, 2011; Sigafoos et al., 2005; Sigafoos et al., 2007; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). Participants in 3 of the studies were diagnosed as having moderate to severe intellectual disabilities (Bereznak, Ayres, Mechling, & Alexander, 2012; Cannella-Malone et al., 2011; Cannella-Malone, Wheaton, Wu, Tullis, & Park, 2012).

Age of the participants ranged from 9 years to 41 years. Seven studies included middle school– and high school–aged students (Bereznak et al., 2012; Cannella-Malone et al., 2011; Cannella-Malone et al., 2012; Mechling et al., 2009; Mechling & Gustafson, 2008; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). Four studies included adults (19-41 years) with autism (Cannella-Malone et al., 2006; Goodson et al., 2007; Sigafoos et al., 2005; Sigafoos et al., 2007). One study included elementary school–aged participants (Rayner, 2011).

Settings

Three studies (Cannella-Malone et al., 2006; Sigafoos et al., 2005; Sigafoos et al., 2006) were conducted in the vocational rooms of the community-based group homes in which the participants resided. Another study was conducted in a vocational training center that the participants attended (Goodson et al., 2007). The remaining eight studies were conducted in a variety of settings within a school environment including classrooms, cafeterias, living rooms, laundry rooms, and teacher workrooms (Bereznak et al., 2012; Cannella-Malone et al., 2011; Cannella-Malone et al., 2012; Mechling et al., 2009; Mechling & Gustafson, 2008; Rayner, 2011; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006)

Target Skills

Cooking-related tasks were targeted in six studies (Bereznak et al., 2012; Mechling et al., 2009; Mechling & Gustafson, 2008; Sigafoos et al., 2005; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). Of these studies, two tasks focused on operating a conventional oven or stove (Mechling et al., 2009; Mechling & Gustafson, 2008) and the others focused on operating a microwave oven. Other daily living skills targeted included setting a table (Goodson et al., 2007) and putting away groceries (Cannella-Malone et al., 2006), washing dishes (Cannella-Malone et al., 2011; Sigafoos et al., 2007), washing laundry (Bereznak et al., 2012; Cannella-Malone et al., 2011), folding laundry (Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006), washing a table (Cannella-Malone et al., 2011; Van Laarhoven & Van Laarhoven-Myers, 2006), using a copy machine (Bereznak et al., 2012), shoe-tying (Rayner, 2011), and sweeping (Cannella-Malone et al., 2011).

Research Design

Single-case research methods were used in all of the studies included in this review. Single-case research designs typically incorporate several features including the participant acting as his or her own control, detailed descriptions for replication, clearly defined variables, baseline data collection, experimental control, and social validity measures to address practicality (Horner, Carr, Halle, & McGee, 2005).

Horner et al. (2005) have used these features of single-case research to develop a list of 21 quality indicators. These indicators were designed to determine whether the study "meets the minimally acceptable levels that permit interpretation" (p. 173) and cover seven different categories: (a) description of participants and settings, (b) dependent variable, (c) independent variable, (d) baseline, (e) experimental control/internal validity, (f) external validity, and (g) social validity. All 12 studies were reviewed in accordance to their adherence to the 21 quality indicators. A yes or no response was given for each indicator. Every study had at least 19 of the quality indicators. Two studies that did not adhere to all 21 of the indicators did not collect multiple measurements during baseline; they conducted a pre-test of the skill being taught (Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). Repeated, consistent measurement of the dependent variable during baseline allows the researcher to predict future responding (Horner et al., 2005).

Seven of the studies used an adapted alternating treatments design (Cannella-Malone et al., 2011; Cannella-Malone et al., 2006; Cannella-Malone et al., 2012; Mechling & Gustafson, 2008; Rayner, 2011; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006), where different interventions were alternated (e.g., video modeling, video prompting, picture prompting, video prompting with error correction). Bereznak et al. (2012), Cannella-Malone et al. (2006), Cannella-Malone et al. (2011),

Cannella-Malone et al. (2012), Goodson et al. (2007), Rayner (2011), Sigafoos et al. (2005), and Sigafoos et al. (2007) all utilized a multiple-probe across subjects design, whereas Mechling et al. (2009) implemented a multiple-probe across skills design.

Effectiveness of Video Prompting/Performance of Target Behavior

All 12 studies included in the review reported gains in target skills after instruction via video prompting to varying degrees. On visual inspection of the graphs provided, 7 of the 12 studies had 100% non-overlapping data for the video prompting condition for all participants with ASD (Bereznak et al., 2012; Mechling et al., 2009; Mechling & Gustafson, 2008; Sigafoos et al., 2005; Sigafoos et al., 2007; Van Laarhoven et al., 2010; Van Laarhoven &Van Laarhoven-Myers, 2006). Participants in Goodson et al. (2007) displayed 100% non-overlapping data when video prompting was combined with error correction procedures. Percentage of non-overlapping data (PND) is used to determine the proportion of data points that are shared between baseline and intervention conditions (Scruggs, Mastropieri, & Casto, 1987). Kazdin (1978) stated, "If performance during an intervention phase does not overlap with performance during the baseline phase when these data points are plotted over time, the effects usually are regarded as reliable" (p. 637). Five studies did not have 100% PND for all participants with ASD. Cannella-Malone et al. (2011) had one participant with one overlapping data point, giving that particular student a PND score of 89%. In another study, two students had one overlapping data point as well; however, both of these students experienced this overlap on the first day of the intervention phase (Cannella-Malone et al., 2006). These two students had PND scores of 93% and 95%.

Of the three participants in the Rayner (2011) study, one had 100% non-overlapping data, another had 75% non-overlapping data, and another had 78% non-overlapping data. Overall, the participants were unable to meet criterion with video prompting alone, however, and required in vivo instruction with backward chaining to master the target skill (shoe-tying). The three participants with autism in the Goodson et al. (2007) study also had varying degrees of overlapping data. Two students displayed 100% non-overlapping data and the other had 0% non-overlapping data when the skill was taught with video prompting alone. When error correction was combined with video prompting, however, the student displayed 91% non-overlapping data.

Bereznak et al. (2012), Sigafoos et al. (2005), and Sigafoos et al. (2007) all looked at the efficacy of video prompting alone, without comparing it with other interventions. The dependent variable for these studies was the number or percentage of correct responses. The participant with autism in the Sigafoos et al. (2005) study advanced from a 0% to 20% independent responding rate during baseline to a 100% rate during video prompting within five sessions. Sigafoos et al. (2007) also reported large gains in the percentage of steps performed independently immediately after the introduction of video prompting. These high levels of performance were attained within 10 sessions. Bereznak et al. (2012) noted gains on introduction of video prompting as well, with two of the three students in this study navigating through the video prompts independently. Two studies evaluated video prompting with error correction procedures (Cannella-Malone et al., 2012; Goodson et al., 2007). Both of these studies reported that error correction improved skill acquisition. The participant with autism in the Cannella-Malone et al. (2012) study, however, did not meet criterion for one of the target skills (sweeping) and required in vivo instruction.

Video Prompting Compared With Static Picture Prompts

Mechling and Gustafson (2008) and Van Laarhoven et al. (2010) compared video prompting with static picture prompts (static photographs of an individual completing the target skill). The two studies noted that both interventions were effective, although video prompting resulted in a greater number of independent correct responses. Mechling and Gustafson (2008) reported that this difference in percentage of correct tasks was 78.2% when video prompting was used and 39.2% when static picture prompts were used. In addition to reporting gains in independent correct responses, Van Laarhoven et al. (2010) also looked at the number of external prompts required to use technology. The authors found that fewer external prompts were

required in the video prompting condition. Video prompting and static picture prompts were also analyzed in terms of efficiency, number of error correction prompts, and number of sessions to reach criteria. The authors compared the amount of time required to create the instructional materials for both conditions with the ratio of growth for each participant. The video prompting condition was the most efficient condition in terms of this efficiency measure. Video prompting was also shown to have a lower percentage of error correction prompts (6%) compared with picture prompts (14%) and required the same number of sessions to meet criterion as the picture prompting condition.

Mechling et al. (2009) studied student-controlled prompting in which the participants had the option of self-selecting either picture, auditory, or a video prompt based on personal preference. Results showed an immediate improved performance using the prompting device in terms of independent correct responding. The study also looked at the percentage of prompt levels selected by the students and reported that participants selected the video prompting condition more than the picture prompts with audio. After multiple sessions, however, students self-adjusted their prompting level to the picture condition, suggesting an ability and desire to systematically fade prompts after skill acquisition.

Video Prompting Compared With Video Modeling

Three of the studies compared video prompting with video modeling (Cannella-Malone et al., 2011; Cannella-Malone et al., 2006; Van Laarhoven & Van Laarhoven-Myers, 2006). Cannella-Malone et al. (2006) and Cannella-Malone et al. (2011) reported positive gains for students using video prompting in terms of percentage of correct independent responding. Three participants in the Cannella-Malone et al. (2011) study, however, required error correction procedures using video prompts and in vivo demonstrations. Video modeling was shown to be generally ineffective in both studies.

Van Laarhoven and Van Laarhoven-Myers (2006) also found that an intervention package with video prompting was more effective than video modeling. Researchers in this study compared video modeling, video modeling followed by picture prompts, and video modeling followed by video prompts. Dependent variables included percentage score for levels of assistance, percentage of independent correct responses, number of prompts to use instructional materials, and number of sessions to reach criterion. The only participant with ASD in this study displayed a higher percentage of correct independent responses and more independence on levels of assistance measures when presented with the video modeling plus video prompting condition as opposed to video modeling alone. Video modeling with video prompting and video modeling with picture prompting both resulted in faster acquisition of the target skills than the video modeling condition.

Contradictory to the Van Laarhoven et al. (2010) study, participants in Van Laarhoven and Van Laarhoven-Myers (2006) study required more external prompts to attend to the intervention package that included video prompting. The authors noted that this could have been due to the student self-fading prompt levels after the skill was already acquired.

Student Attention to the Video and Perspective

Another factor to consider for the each of the studies is the model that was used in the videos. Possible options for the model or person completing the task are peer models, adult models, or self-models. Students are more likely to attend to a model that is most similar to themselves and their experience (Bandura, 1977). Adult models were used in all but one of the studies. Rayner (2011) utilized both adult and peer models. In addition, this study used a twin sibling as a model for one of the students. Participants in this study did not display a significant difference in performance regardless of the model used.

None of the studies presented a direct comparison of the point of view of the video presented. Studies that used a performer-based perspective filmed the video so that the viewer was watching the skill be conducted with only the hands and arms of the model being shown. The six studies that used video prompts filmed only from the perspective of the performer (Bereznak et al., 2012; Cannella-Malone et al., 2011; Cannella-Malone et al., 2006; Rayner, 2011; Sigafoos et al., 2005; Sigafoos et al., 2007) all showed positive

gains in the targeted skills. Studies that used a spectator-based perspective filmed the video so that the viewer was watching the skill be conducted by another person in the room. Mechling and Gustafson (2008), Mechling et al. (2009), Cannella-Malone et al. (2012), and Goodson et al. (2007) all used videos filmed from the perspective of the spectator and reported comparable findings with the studies above with regard to acquisition of target skills and independent correct responding. Similarly, the two studies that used a combination of both performer and spectator perspectives noted positive gains (Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006).

Student Reproduction (Generalization) and Motivation (Maintenance)

Conflicting results were reported in the 12 studies with regard to the generalization and maintenance of target skills. Sigafoos et al. (2005), Van Laarhoven and Van Laarhoven-Myers (2006), and Van Laarhoven et al. (2010) all noted that students were able to maintain the target skills after the removal of video prompting. Sigafoos et al. (2005) collected maintenance data at 2, 6, and 10 weeks, and the participant continued to perform between 80% and 100% of the target skills independently. Some authors conducted maintenance and generalization data collection 6 weeks after the removal of the intervention (Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). Both studies gave post-tests in novel environments using different materials but the same skill. The participant in the Van Laarhoven and Van Laarhoven-Myers (2006) study had higher post-test scores in the skills where video prompting was used in combination with video modeling compared with those who were taught using video modeling alone or video modeling with photo prompts. Participants in the Van Laarhoven et al. (2010) performed similarly, with students demonstrating a higher percentage of independent correct responding during the post-generalization tests for the skill taught using video prompting rather than picture prompts. One of the students in the study only maintained the skill that was taught using video prompting.

Three studies reported difficulties with maintenance of target skills post intervention (Mechling & Gustafson 2008; Sigafoos et al., 2007; Bereznak et al., 2012). Of the six participants in the Mechling and Gustafson (2008) study, three displayed a drop in performance when video prompting was removed in comparison with two who regressed when picture prompts were removed in the same study. It is of interest to note that one student regressed after the withdrawal of video prompts and refused to participate without the DVD player and video prompting. Sigafoos et al. (2007) also reported a deterioration of performance when video prompting was removed. To address this issue, the authors of this study created and implemented a procedure that they called video chunking. Video chunking was a three-step procedure where the video prompts were systematically combined to create multi-step videos. The 10 video prompts were merged to form 4 videos, then 2 videos, and finally 1 video. Two of the three participants continued to perform with 90% to 100% accuracy after the one "chunk" video was withdrawn. Two participants in the Bereznak et al. (2012) study displayed a decrease in performance during maintenance sessions. After reintroduction of the iPhone, the students were able to rebound to criterion-level performance.

Several studies did not provide information about maintenance data (Cannella-Malone et al., 2011; Cannella-Malone et al., 2006; Cannella-Malone et al., 2012; Goodson et al., 2007; Mechling et al., 2009). Cannella-Malone et al. (2006) and Mechling et al. (2009) reported that participants maintained high levels of performance for the target skills after video prompting was removed, but neither study gave information about when these maintenance sessions were conducted. Cannella-Malone et al. (2011) was limited by the time restraints of the school year and was unable to collect maintenance data.

Social Validity

Only Van Laarhoven et al. (2010), Rayner (2011), and Mechling et al. (2009) formally looked at social validity. In Van Laarhoven et al. (2010), participants were asked which intervention they preferred; all participants stated that they preferred video prompting to picture prompts. Parents were also asked about the intervention effects and all replied favorably. Rayner (2011) provided classroom teachers with a survey regarding the intervention. Teachers had varying responses regarding the importance of the skill being

taught, the student level of independence after being taught the skill, and the perceived interest of the students for the intervention. Although informally addressed, Bereznak et al. (2012) reported that the participants demonstrated interest in the portable technology used, "boasting" about using the iPhone to teachers and family members.

Discussion

The need for evidence-based practices in school systems is of growing concern while daily classroom demands often make it difficult for teachers to identify empirically based interventions independently (Simpson, 2005). The goal of this review was to determine whether video prompting techniques are an effective intervention, as well as to examine the factors that may affect student attention, retention (performance) of target behavior, production (generalization) of target behavior, and motivation (maintenance of target behavior). The data analyzed in this review illustrated that video prompting is a promising intervention for teaching daily living skills to individuals with ASD.

Attention

Participants were able to attend to the video prompts better than the full-length video required for video modeling. Cannella-Malone et al. (2006) observed that students appeared to be more engaged in the video clips that typically were less than 30 s in length, and often looked away during the full-length video modeling component that was typically several minutes in length. This finding mirrors previous research supporting evidence that students with ASD have impairments in attention (Allen & Courchesne, 2001; Ames & Fletcher-Watson, 2010). These deficits are seen across many domains of attention but are most pronounced for social attention skills, which involve looking and focusing on other people (Ames & Fletcher-Watson, 2010). Video instruction requires student attention to the teacher model via video, which could be problematic due to attentional delays. Breaking skills into smaller units could make the skill more attainable. The smaller video segments also allow students to attend to the most salient features of the tasks, which often is difficult for children with ASD (Quill, 1997).

In addition to attention deficits, video prompting may also address documented deficits in information processing, memory, and imitation (Minshew & Williams, 2008; Poirier et al., 2011; Rogers & Pennington, 1991; Williams et al., 2005). Due to impairments in short-term memory, shortened video prompts may ensure that the student's memory is not taxed (Poirier et al., 2011). Minshew and Williams (2008) stated that when tasks contain multiple components or have increased time demands, performance for individuals with ASD deteriorates. Whole task presentation such as that done in video modeling places a demand on information processing and imitation skills that are already delayed (Minshew & Williams, 2008; Rogers & Pennington, 1991). Individuals with ASD have been found to be significantly impaired in overall imitation abilities in many domains compared with their typically functioning peers, even after controlling for developmental levels (Rogers, Hepburn, Stackhouse, & Wehner, 2003). Therefore, students with ASD may be more successful imitating smaller segments than the whole task presentation.

Further rationale for shortened segments is research centered on central coherence, which states that smaller units of information are desirable for individuals with ASD. *Weak central coherence* is a term used to describe impairments in perceiving parts as a whole and a bias toward detail-focused processing (Happé & Frith, 2006). This characteristic is so common in individuals with ASD that it was included as part of the criteria for diagnosing autism (Happé & Frith, 2006). Specifically, the criteria state that individuals with ASD can have a "persistent preoccupation with parts of objects" as per the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association [APA], 2000, p. 70). Forward chaining tasks allow a student to focus on these small details rather than the entire task and thus aid in central coherence development. To avoid prompt dependence as students gain mastery in the small steps, prompts need to be systematically faded (O'Donohue & Fisher, 2008). Future research should look at fading procedures such as the "video-chunking" procedure described by Sigafoos et al. (2007) to help students put these skills together.

Other components that could affect student performance in video prompting instruction are voiceover and the model used in the video. All of the studies included audio or text voiceover in their video prompts. Without isolating this component, one is unable to determine whether the voiceover narration is partly responsible for the intervention effects. It is of interest to note, however, that one of the participants in the Cannella-Malone et al. (2011) study was diagnosed as having a bilateral hearing loss and showed high levels of performance under the video prompting condition. This suggests that the audio voiceover may not have interfered with the effectiveness of video prompts. Other research has shown that audio voiceover on video models increases student performance in terms of independent correct performance (Mechling & Collins, 2012).

As noted previously, participants are more successful in attending to a task when the models and experiences are similar to themselves (Bandura, 1977). Following the SLT, a video using a performer-based perspective would most closely resemble the experience of the student. However, studies included in this review demonstrated similar intervention results for both performer and spectator-based videos suggesting that students were able to attend to both perspectives. This mirrors other findings related to video perspective (Ayres & Langone, 2007; McCoy & Hermansen, 2007; Mechling & Moser, 2010). Although they differed in terms of perspective, 11 of the 12 studies used adults as models rather than peers who were similar to the participants or the participants themselves (video self-modeling). In a study by Cihak and Schrader (2008), individuals with ASD were taught vocational skills using video-based instruction. The author compared video adult modeling as well as video self-modeling. Although results in terms of performance varied, all of the participants stated that they liked to watch the self-model video more than the adult model. Given these mixed findings, future research should look at the effect of using video self-modeling or peers who are similar to the participants in the video prompts.

Although it has been shown that students with ASD perform better with smaller units of information, little research has been done to determine the optimal length of video segments or number of steps presented. Eight of the 12 studies in this review reported video segment length (Cannella-Malone et al., 2011; Cannella-Malone et al., 2006; Cannella-Malone et al., 2012; Goodson et al., 2007; Mechling et al., 2009; Mechling & Gustafson, 2008; Sigafoos et al., 2005; Sigafoos et al., 2007). Video segment length varied from 3 to 42 s. In the studies that compared with a video modeling condition, video modeling ranged from 1 min, 37 s to 2 min, 42 s (Cannella-Malone et al., 2011; Cannella-Malone et al., 2006). Future research should look at optimal video segment lengths for skill acquisition, due to memory and attention span deficits for individuals with ASD. Similarly, the number of steps in each task could play a role in the success of the student. Just as in a task analysis, decisions need to be made on how much information students can understand in each step. Analyzing which components of video prompting are most effective, such as segment length and number of steps in a task, will help maximize student achievement.

Retention/Performance

Video prompting resulted in improved student performance in several realms. In two studies, students displayed an increased rate of independent responses in less than 10 sessions (Sigafoos et al., 2005; Sigafoos et al., 2007). In terms of number of correct independent responses, video prompting techniques were shown to be more effective than static picture prompts (Mechling & Gustafson, 2008; Van Laarhoven et al., 2010) and video modeling (Cannella-Malone et al., 2011, Cannella-Malone et al., 2006; Van Laarhoven & Van Laarhoven-Myers, 2006).

Video prompting was shown to be effective for a wide age range of students (9-41 years), yet only one study examined using video prompting with elementary school–aged children. This could be due to the nature of the daily living skills that were being taught. Typically, skills such as cooking and household chores are taught to older children who will be making the transition into independent living. Although this review looked only at using video prompting with individuals with ASD, the studies also included participants with other developmental disabilities such as intellectual disabilities (Cannella-Malone et al., 2011; Sigafoos et al., 2005; Van Laarhoven & Van Laarhoven-Myers, 2010), Down syndrome (Van Laarhoven & Van Laarhoven-Myers, 2010), and fragile X syndrome (Cannella-Malone et al., 2011). Participants with

other disabilities performed similarly to those with ASD, suggesting that video prompting is a useful intervention for other populations. It is of interest to note that other studies (Cihak, Alberto, Taber-Doughty, & Gama, 2006) have found video prompting to be slightly less effective than picture prompts for individuals with attention-deficit/hyperactivity disorder (ADHD). One potential explanation for this is that students with ADHD could lose focus during the video prompts due to movement of the video, environmental distractors, and irrelevant information in the video (Alberto, Cihak, & Gama, 2005).

The majority of the participants in this review had mild to moderate disabilities. Mechling and Gustafson (2008) proposed more research be done involving disability level and video prompting, posing the question whether video-based instruction would be an effective intervention for students with poor imitation skills who required higher-level, physical prompts. In this review, Cannella-Malone et al. (2011) were the only researchers who reported on individuals with more severe delays and although the participants saw positive gains, they did not find the high acquisition rates of the other studies. Speed of acquisition is an important factor when considering the effectiveness of an intervention. The faster a student acquires a skill, the faster a teacher can move on to teaching new material. For students who are already far behind their typically functioning peers, this could mean that a student has a greater chance of "catching up." High acquisition rates in the video prompting conditions could have been due to student preference for the video prompting conditions. Shorter time segments and video-based instruction could have optimized information processing. Reinforcement could also be an explanation. Several studies discussed that the technology component itself was reinforcing. In addition, many of the studies required students to prepare or cook a snack that they were then allowed to consume. This tangible reinforcer could have motivated students to work to perform the task quickly.

Reproduction/Generalization

In addition to being effective for a wide age and disability range, video prompting procedures also were effective in a variety of environments including school, home, and residential settings. When collecting maintenance data, three of the studies used novel settings and materials (Rayner, 2011; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). Participants were able to perform the target task independently in these situations; however, none of the studies used the video prompts for instruction in community setting (e.g., grocery store or restaurant).

Motivation/Maintenance

Many of the participants were able to retain the skills demonstrated in the video for up to 10 weeks after the prompts were removed (Sigafoos et al., 2007; Van Laarhoven et al., 2010; Van Laarhoven and Van Laarhoven-Myers, 2010). The video component may have made the information related to the skill easier to maintain due to the visual strengths of individuals with ASD (Hayes et al., 2010; Quill, 1997). In some visual skills, such as visual searching, individuals with ASD have been shown to perform better than their typically functioning peers (O'Riordan, Plaisted, Driver, & Baron-Cohen (2001). After acquiring the target skill, one participant in the Van Laarhoven and Van Laarhoven-Myers (2006) study stated that he did not need to watch the video prompts anymore because he could "play the video in his head" (p. 377). Students who had difficulty maintaining target skills showed improvements using the more gradual fading procedure termed "video-chunking" (Sigafoos et al., 2007).

Limitations

Horner et al. (2005) indicated quality performance indicators for research studies using a single-subject design. Although the studies included in this review met most of these indicators (e.g., description of participants and settings, reliability, and inter-observer agreement data), one indicator that was consistently overlooked was social validity. Only three studies (Mechling et al., 2009; Rayner, 2011; Van Laarhoven et al., 2010) formally looked at social validity measures. The students in one study were asked which

intervention they preferred, and parents and teachers were asked whether they believed the procedure had a positive effect. Students, teachers, and parents all responded favorably (Van Laarhoven et al., 2010). In the Rayner (2011) study, however, teachers had varying responses in terms of the validity of the intervention. Another limitation, as previously stated, is that studies should collect multiple data points during baseline to allow for trend prediction. Future studies should look at social validity measures to determine whether the target skill is socially important, as well as conduct repeated measurement of the dependent variable during baseline.

Implications for Practice and Future Research

Teachers who wish to use video prompting in their classroom could see a number of benefits. In addition to providing consistency for instruction, the potential for self-directed learning could be beneficial in many environments. The use of video prompts would decrease the time needed to train para-professionals to teach these skills. The prompts could then be used as an error correction procedure if the skill was not maintained over time. Despite the many benefits of video prompting, teachers in the Van Laarhoven et al. (2010) study reported that although video prompting was shown to be more effective than static picture prompts, teachers were more likely to use picture prompts because they were more familiar. Teachers should be provided with effective professional development and support on the use of technology in their classrooms (Schrum, 1999).

With technology becoming more portable, teachers also could use video prompts to provide instruction in the grocery store, public transportation, workplace, and so on. Video prompting has been shown to improve employment-related skills for an individual with a developmental disability using an iPod (Van Laarhoven et al., 2009). In this study, the employers of this individual believed that the video prompting techniques on the iPod were very beneficial. Future research should look at using more portable devices such as these so that instruction can take place in community settings. Portable devices such as iPods and iPads are so common in today's society that students could use video prompting to gain independence in settings where typical instruction does not occur.

Error correction procedures and external prompting should also be considered when reporting future research. The two studies that formally compared error correction procedures (Cannella-Malone et al., 2012; Goodson et al., 2007) both noted that error correction improved skill acquisition. Two studies offered conflicting evidence of the need for external prompts to use the technology presented during video prompting (Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006). The use of external prompts could affect the efficacy of the intervention. Future studies should consider the impact of external prompting on skill acquisition, especially when comparing video prompting with other interventions such as video modeling or in vivo instruction.

Overall, the data presented in the studies suggested that video prompting has the potential to teach a wide array of skills to individuals with developmental disabilities, and autism in particular. The chaining task allows the student to feel self-efficacious throughout instruction, hereby motivating the student to attempt more challenging tasks (Bandura, 1993). Students were successful in attaining, generalizing, and maintaining the target skills taught using video prompting. Video prompting also was shown to be more effective than static picture prompts and video modeling techniques that are commonly used interventions. Recent advances in technology offer great potential for improving the independence of students with ASD through video prompting methods.

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