LSHSS

Tutorial

Incorporating Video Modeling Into a School-Based Intervention for Students With Autism Spectrum Disorders

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Purpose: Video modeling is an intervention strategy that has been shown to be effective in improving the social and communication skills of students with autism spectrum disorders, or ASDs. The purpose of this tutorial is to outline empirically supported, step-by-step instructions for the use of video modeling by school-based speech-language pathologists (SLPs) serving students with ASD.

Method: This tutorial draws from the many reviews and meta-analyses of the video modeling literature that have been conducted over the past decade, presenting empirically supported considerations for school-based SLPs who are planning to incorporate video modeling into their service delivery for students with ASD. The 5 overarching procedural phases presented in this tutorial are (a) preparation, (b) recording of the video model, (c) implementation of the video modeling intervention, (d) monitoring of the student's response to the intervention, and (e) planning of the next steps.

Conclusion: Video modeling is not only a promising intervention strategy for students with ASD, but it is also a practical and efficient tool that is well-suited to the school setting. This tutorial will facilitate school-based SLPs' incorporation of this empirically supported intervention into their existing strategies for intervention for students with ASD.

Key Words: video modeling, video self-modeling, autism spectrum disorder, school-based, speech-language pathology

Autism spectrum disorders (ASDs) are a set of complex developmental disorders that involve impairments in social interaction and communication as well as patterns of repetitive behaviors and/or restricted interests (American Psychiatric Association, 2000). Between 1996 and 2005, American classrooms saw a threefold increase in the percentage of school-age students with ASD served under the Individuals with Disabilities Education Act (U.S. Department of Education, 2010). The varied skill and need profiles of this still-increasing population of students make educational programming and the provision of services challenging, necessitating the use of individualized empirically supported strategies. However, educational professionals, including speech-language pathologists (SLPs), have reported feeling underprepared to work with students who have been diagnosed with ASD (Schwartz & Drager, 2008). Furthermore, although the American Speech-Language-Hearing Association (ASHA, 2005) urges its members to find and critically evaluate current literature for use in clinical practice, school-based SLPs (among other educational professionals) have cited a lack of time for accessing research due to large caseloads, understaffing, and insufficient planning time (Closs & Lewin, 1998; Curtin & Jaramazovic, 2001; Roberts & Barber, 2001). As such, school-based SLPs could benefit from tutorials drawn from the research literature that outline clear, step-by-step instructions for the use of practical, research-based intervention strategies for students with ASD. Such empirically based information could be considered along with the additional components of evidence-based decision making, clinical expertise, and team (including student and family) preferences.

This tutorial focuses on the cost-effective, practical, and empirically supported intervention strategy of video modeling (Nikopoulos, Canavan, & Nikopoulou-Smyrni, 2009; Sherer et al., 2001; Simpson, Langone, & Ayres, 2004). Video modeling is the presentation of a model performing a target skill through the use of video technology (Cihak,

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Fahrenkrog, Ayres, & Smith, 2010; Nikopoulos & Keenan, 2007). Video models typically picture a model (e.g., peer, adult) demonstrating positive examples of a desired behavior. With each video model individualized to a child's needs and preferences, video modeling provides a targeted learning opportunity that is much more targeted and individualized than a child simply watching a mass-produced video or television program.

Video modeling is typically implemented by presentation of an individualized video through common video technology, and this presentation may be accompanied by prompts (e.g., to attend to the video segment, to attend to the desired behavior), instructions (e.g., direct statements regarding the expected use of the depicted behavior), and/or reward systems, as appropriate, to facilitate learning. There are multiple variations of video modeling, including traditional video modeling (i.e., video model depicts a person performing the target skill) and video self-modeling (i.e., video model depicts the child him- or herself performing the target skill through video editing). Another variant called point-of-view modeling, wherein the video depicts a situation from the child's point of view but does not actually provide a model, will not be discussed in this tutorial because of this article's focus on tools that use human models. Hine and Wolery (2006) and McCoy and Hermansen (2007) provide more information about point-of-view modeling.

Through more than 3 decades of study, video modeling has been demonstrated to be an empirically supported intervention for children with ASD (Bellini & Akullian, 2007; Hitchcock, Dowrick, & Prater, 2003). Video modeling has been used to improve a range of skills in individuals with ASD, including social, communication, adaptive, and play skills (Shukla-Mehta, Miller, & Callahan, 2010). Reducing problem behaviors (e.g., crying, difficulty transitioning, off-task behavior) has also been targeted with video modeling, particularly video self-modeling (e.g., Coyle & Cole, 2004) or point-of-view modeling (e.g., Schreibman, Whalen, & Stahmer, 2000). Studies of video modeling's effectiveness with individuals with ASD have spanned a broad range of ages (i.e., 3–20 years) and settings (i.e., school, clinic, community, and home), with some studies combining video modeling with other strategies such as instructional prompts or tangible reinforcers (Bellini & Akullian, 2007; Shukla-Mehta et al., 2010).

Although video modeling has been described as an evidence-based practice for children with ASD (Rayner, Denholm, & Sigafoos, 2009), there are many questions that remain surrounding this intervention option. Based on reviews and meta-analyses of the video modeling literature (Ayres & Langone, 2005; Delano, 2007; Rayner et al., 2009; Shukla-Mehta et al., 2010), Table 1 outlines what is known about video modeling and what questions remain to be answered by future research efforts. This list of remaining questions is not exhaustive but reflects what remains to be determined that, in the author's opinion, would be most relevant to school-based SLPs.

Video modeling is thought to promote learning through the principles of behaviorism (Watson, 1997) and social cognitive theory (Bandura, 1969). In terms of its behavioral roots, video modeling can be conceptualized as a manipulable and measurable setting event wherein the child is exposed to a desired behavior in order to influence later responses. Video modeling also incorporates the antecedent behavioral strategy of priming in that the child's sensitivity to a particular situation is increased by viewing the video model. In addition, video modeling aligns with social cognitive theory in its provision of vicarious reinforcement through the observation of another person's success. Finally, video modeling relies on the social cognitive model of learning termed *observational learning,* which posits that a child learns through observing and imitating others' behavior. Through the use of individualized video modeling, observational learning can be geared toward the acquisition of behaviors that have social merit for the individual student.

Individuals with ASD have been shown to possess relative strengths in visual processing (Minshew, Goldstein, & Siegel, 1997). Along with this underlying propensity, the effectiveness of video modeling in changing the behavior of children with ASD has been attributed to the reduced attention and language demands of the intervention (Sherer et al., 2001), as well as a fascination with screen media that is common to individuals with ASD (Mineo, Ziegler, Gill, & Salkin, 2009). Another explanation for the success of this intervention with individuals with ASD is that video modeling provides a means of instruction that does not require the face-to-face interaction that may be aversive to individuals with ASD (Corbett & Abdullah, 2005). Finally, review of the extant video modeling literature suggests that various combinations of these factors may serve to increase children's motivation and, thus, their attention to the intervention (Bellini & Akullian, 2007).

Given the social and communicative needs of children with ASD, and SLPs' need for empirically supported interventions for this population, video modeling may be an ideal option to consider within an evidence-based model of decision making. Based on the existing literature, video modeling is a promising intervention for addressing the following goal areas in the SLP's scope of practice: play (individual and reciprocal), perspective taking (e.g., responding correctly to theory-of-mind tasks, assuming the role of another person/character), conversation/greetings, adaptive/functional skills (e.g., cleaning, purchasing), and social initiation (Ayres & Langone, 2005; Bellini & Akullian, 2007; Shukla-Mehta et al., 2010). With their expertise in addressing social and communication skills, and the flexibility of their mode of service delivery, SLPs are in a unique position to individualize students' interventions and incorporate video modeling into one-on-one or consultative services. This tutorial focuses on the use of video modeling within the framework of school-based speech-language pathology

Table 1. Overview of video modeling evidence.

What we know about video modeling[a]	*Questions that remain about video modeling*
• Video modeling has produced positive effects in a variety of areas (e.g., functional skills, communication, social skills) in children with autism spectrum disorders (ASD) in a variety of settings (e.g., home, clinic, school) (Ayres & Langone, 2005; Delano, 2007; Rayner, Denholm, & Sigafoos, 2009; Shukla-Mehta, Miller, & Callahan, 2010). • Skills gained through video modeling are often maintained and generalized (across settings, materials, and people) (Delano, 2007; Rayner et al., 2009). • Video modeling is a socially valid and noninvasive intervention procedure (Delano, 2007). • Video modeling has a high degree of practicality based on consistency, ease of use, and availability of technology (Delano, 2007). • A variety of model types have been used effectively in video modeling (Delano, 2007; Shukla-Mehta et al., 2010). • Some skills are suggested to facilitate greater success with video modeling (e.g., imitation, ability to attend) (Delano, 2007; Shukla-Mehta et al., 2010). • Repeated viewing of video models < 5 min in length is suggested to produce the greatest effects (Shukla-Mehta et al., 2010).	• For whom is video modeling best suited and how can success be best predicted? • How can we predict what model type is best suited to an individual? • What aspects of video modeling or accompanying strategies best promote generalization and maintenance of skills? • What are the effects of video modeling in isolation and when combined with a variety of intervention approaches? • What effects do narration, verbal prompts, or voice-overs have when they are incorporated into the video model? • Are video models more effective when the target behavior is presented as a whole or in segments (i.e., a series of videos)? • What are the effects of video modeling on adolescents and adults with ASD? • What are the critical components of video modeling (e.g., related to content, length, model type, number of models/viewings)? • What other skills and behaviors could video modeling impact (e.g., problem-solving behaviors)?

[a]Cited review articles provide references to the original research articles supporting each claim.

services for students with ASD, offering a rationale for its use and step-by-step instructions for implementation guided by research findings. Table 2 provides specific examples of goals and contexts for school-age video modeling to guide initial consideration of the incorporation of video modeling into school-based services addressing the goal areas presented.

Rationale for Use of Video Modeling

School-based SLPs who are interested in incorporating video modeling into their practice may wish to inform themselves, their educational teams, and/or their administrators about the many advantages of its use. In addition to the research evidence supporting its effectiveness (as outlined earlier), some additional advantages are described in the following paragraphs, including increased child independence, easy individualization, low cost, consistent implementation, and efficient use across professionals and settings.

Increased child independence. Video modeling has been cited as one of the few interventions for students with ASD that fosters independence (Hume, Loftin, & Lantz, 2009). Video modeling encourages independence by shifting the intervention stimulus away from adult instruction and toward a medium that requires very little, if any, adult prompting. In this way, the situation or context of the modeling itself, rather than the adult, becomes the stimulus to elicit the desired or modeled behavior from the student. In addition, although the student may require some assistance and instruction during initiation of the intervention, over time, viewing of the video model can become a completely independent task that he or she initiates. With a growing emphasis on promoting the autonomy of students with ASD (National Research Council, 2001), video modeling presents a promising strategy for SLPs who are seeking to increase students' independence while addressing their social and communication needs. In line with this focus on independence, SLPs should be cautioned to carefully consider their plan for using and fading prompts, especially verbal prompts, which are the most likely to be used alongside video modeling. Such prompts, although sometimes necessary during the initial stages of an intervention, have the potential to produce prompt dependence and inhibit independence and generalization (Hume et al., 2009).

Easy individualization. Because each video model can be designed and recorded for an individual student, video modeling can be easily individualized for students with a broad range of ages, cultures, interests, and functioning levels. Factors that can be manipulated include the video model's setting, content/materials, length, focus, and model type as well as number of participants. When providing services to older students, SLPs will find that it is not only important but simple to incorporate age-appropriate content and preferences into the video model (Delano, 2007). Across

Table 2. Functional examples of goals and contexts for school-based video modeling.

Goal area	*Sample contexts*	*Sample behaviors*	*Sample scenario*
Play	Play area; recess; play group	Functional/symbolic play (motor and verbal behaviors); play sequences; reciprocal play	A preferred peer models two-action symbolic play sequences, including verbal and motor components
Social initiation	Play area; art; lunch; recess	Requesting (e.g., routine, interaction); inviting others into play/activity	Video recordings of the student are edited to compile footage of him reaching to request preferred toys (i.e., video self-modeling)
Conversation/greetings	Recess; lunch; social group; hallway	Taking conversational turns; saying hello and goodbye; responding to questions; asking follow-up questions	A preferred peer model asking basic follow-up questions (e.g., "What else did you do?" "Can you tell me more about that?") during conversation with another peer
Adaptive/functional skills	Bathroom; work areas; lunch	Washing hands; cleaning up materials; purchasing lunch	A familiar adult models the steps involved in paying for lunch in the lunch room
Perspective-taking skills	Social group; lunch; recess; play area	Assuming role of another person; completing theory-of-mind tasks	A familiar adult models correct responses to questions during theory-of-mind tasks, such as "Where will ___ look for the cookie?" (see Charlop-Christy & Daneshvar, 2003)

age groups, preference assessment procedures (e.g., Carr, Nicolson, & Higbee, 2000) can be used to determine the optimal materials and reinforcers for each individualized video modeling intervention. In addition, the SLP's and other team members' knowledge of the student's preferences can guide this process.

Low cost. With the reduced cost and increased efficiency of video technology, schools are increasingly providing tools such as USB-ready video cameras for staff use, increasing the feasibility of the use of video modeling. Furthermore, research has shown that the cost of implementing video modeling (in terms of training, implementation, and materials) is one half the cost of the same modeling delivered live (Charlop-Christy, Le, & Freeman, 2000). For these reasons, video modeling is an excellent intervention option for SLPs with large caseloads and minimal time.

Consistent implementation. Video modeling also allows a student's educational team to provide consistent teaching of a target skill throughout the school day, with minimal demands on team members (Ayres & Langone, 2005). Because video modeling allows for repeated exposure to the same context and modeled behavior, the stimulus becomes predictable, allowing students to focus on the model's behavior. Such consistency may be important for some students with ASD who may become distracted by the unpredictable, less consistent, and multimodal nature of live instruction. In addition, as the student learns to use the modeled behavior, the video model can be adapted to expand the student's skills to handle more complex contexts and behaviors.

Efficient use across professionals/settings. With minimal training (Charlop-Christy et al., 2000) and little to no disruption to the daily routine, classroom-based team members (i.e., teachers, teaching assistants, and program aides) can easily incorporate video modeling into the regular classroom routine. Similarly, to ensure consistent intervention across a student's entire day, family members and professionals who provide after-school services can incorporate SLP-made video models into daily routines. A video model can be shared through a USB flash drive; however, it is important to pay special attention to the legal and ethical concerns (e.g., need for releases and plans to ensure confidentiality) that accompany such video sharing if the SLP decides to use a peer model (McCoy & Hermansen, 2007) or to share the video outside of the school context.

With these advantages in mind, SLPs can advocate for the incorporation of video modeling into their clinical practice with students with ASD. The following section outlines step-by-step instructions for the implementation process, from the beginning preparatory phase to final considerations about monitoring student progress and determining next steps for intervention, guided by available evidence-based data.

VIDEO MODELING IMPLEMENTATION: A FIVE-PHASE PROCESS

Implementation of video modeling is a process that requires consideration of multiple factors, resulting in an intervention procedure that is individualized to each student.

There are five overall procedural phases outlined in this tutorial: (a) preparation, (b) recording of the video model, (c) implementation of the video modeling intervention, (d) monitoring of the student's response to the intervention, and (e) planning of next steps. The various tasks associated with each of these phases are outlined in the following sections in an easy-to-use guide for SLPs who are serving students with ASD.

Phase 1: Preparation

The preparation phase consists of a series of steps aimed at determining whether video modeling is an appropriate intervention strategy for a particular student, and if so, what the video model will look like. This latter stage of the preparation process involves a series of decisions regarding the video model's target skill, model type, setting, and scripted features.

Assessing related skills. In order to determine whether video modeling is an appropriate intervention strategy for a particular student, the SLP should first assess that student's specific skills and preferences. Skills linked to success with video modeling and suggested criteria are provided in Table 3 and are supported by published reviews of the video modeling literature (Delano, 2007; Rayner et al., 2009; Shukla-Mehta et al., 2010).

When assessing a student's ability to attend to a video for a period of time, it is recommended that trials be completed with a video that depicts real people (vs. animation), as that is the type of video the SLP will be using during the intervention. The remaining skills included in Table 3 can be assessed through classroom observation or targeted assessment procedures.

Choosing an appropriate target skill. Not all social and communication skills are appropriate targets when using video modeling as an intervention tool. Target skills must be skills that can be clearly modeled and easily observed. For example, *internal* skills that fall under categories such as receptive language (e.g., comprehending vocabulary words) or social understanding (e.g., recognizing others' emotions) are not appropriate targets for video modeling unless they can be linked to observable correlate behaviors (e.g., identifying corresponding pictures, objects, or words). Observable, *external* skills such as offering greetings, requesting, taking turns in play, or initiating interactions represent the most appropriate skills to target through video modeling.

Table 3. Skills linked to success with video modeling and suggested criteria as per Shukla-Mehta et al. (2010), Delano (2007), and Rayner et al. (2009).

Related skill	*Suggested criteria*
Visual attention	Exhibits ability to attend to a video for at least 1 min (several minutes of attention may be an even better indicator)
Imitation	Exhibits basic imitation skills (e.g., motor or verbal, depending on target skill)
Visual and hearing acuity	Exhibits acuity within normal or corrected-normal limits
Visual information processing and comprehension	Exhibits functioning level appropriate for length and complexity of video (note that higher skill levels in these areas may be related to better outcomes with video modeling)

A target skill can be chosen for a student based on the student's individualized education plan or other apparent or documented needs. Careful assessment of existing skills in the chosen domain (e.g., requesting, social interaction) can be conducted to determine the student's potential to achieve a target skill. For example, the student may show the more basic social interaction skill of attending to others during interactions before exhibiting a higher level social interaction skill such as combining gestures and eye contact to initiate an interaction. However, it is important to note that not all students will follow the same developmental patterns. Careful assessment will allow the SLP to determine the student's potential to gain the target skill by determining whether the target skill is emerging (Wert & Neisworth, 2003). A skill that is emerging or can be elicited through prompting is an ideal target because it lies within the student's zone of proximal development, a concept developed by Vygotsky (1978) that refers to a child's range of ability when provided with adult support (i.e., not produced independently).

Finally, assessment tools and consultation with the student's team (including caregivers) can aid the SLP in determining whether the student is failing to exhibit a skill due to lack of ability or lack of motivation. Consultation with the team will also allow the SLP to assess the social validity (i.e., endorsement by stakeholders as meaningful and appropriate) of the goal/target skill. For example, the SLP could organize formal or informal communication (e.g., meetings, e-mails, conference calls) with the student's team members (e.g., teacher, teaching assistant, caregiver) to discuss members' observations/assessments of the student and to collaboratively decide on a target skill that the team agrees is important to the child's daily life. This collaborative process will not only inform the SLP's decision regarding whether or not to target a certain skill, but may also affect the choice of materials, setting, and/or model type. In addition, the SLP may work with other team members to create video models to address other educational goals, such as reducing problem behavior.

Some standardized instruments recommended for use with students with ASD include the current editions of the Children's Communication Checklist (Bishop, 2003) for all aspects of communication, including speech, language, and pragmatics (e.g., nonverbal communication, social

relations); the Social Responsiveness Scale (Constantino, 2002) for reciprocal social interaction, social processing, and social anxiety; the Social Language Development Test: Elementary or Adolescent (Bowers, Huisingh, & LoGiudice, 2008, 2010) for perspective taking and making social inferences; and the Autism Diagnostic Observation Schedule, Second Edition (ADOS–2; Lord et al., 2012) for a variety of social and communication behaviors. Specific administration training is required for diagnostic use of the ADOS–2; however, this diagnostic tool may be used in an alternative manner to assess specific skill and deficit areas through administration of targeted tasks (e.g., elicitation of joint attention, prompts for conversation).

Choosing a model type. Options for model types broadly include *self* and *other*; however, within the other category, several options exist. For example, the other model may be a sibling, peer, parent, teacher, or SLP; may be familiar or unfamiliar; and may be typically developing or atypically developing. Research has not documented any difference between the effectiveness of video modeling when conducted with self or other as the model (Bellini & Akullian, 2007; Sherer et al., 2001), and the intervention has been proven effective using all types of models, including peers, adults, and self (McCoy & Hermansen, 2007). Consideration of an individual student's traits (e.g., age, gender) and preferences, as well as the nature of the target skill, will dictate the characteristics of the person best suited to model the target skill.

Considerations involved in choosing a model type may include the student's age, gender, race/ethnicity, and preferences, as well as any logistical barriers to the recording process. For example, when serving a preschool-age student with ASD, there are viable concerns regarding the time required (for the SLP and for the model) to adequately train a peer model (Bellini & Akullian, 2007). Bandura's (1969) early work on behavior modeling posited that social factors (e.g., authority, popularity, perceived competence of model), as well as the motivation and characteristics of the observer, determine the observer's attention to the model. With this in mind, SLPs using an *other* model in a video may wish to choose a familiar, preferred/respected peer or a familiar adult whom the child likely perceives as an authority. Peer models are generally matched to the student's approximate age and gender and are commonly typically developing (McCoy & Hermansen, 2007). When targeting skills in areas such as social interaction or reciprocal play, a second individual (peer or adult) may be included in the recording as a facilitator or interaction partner.

Studies of video self-modeling suggest that using self as the model is most effective when the goal is to reduce problem behaviors or increase compliance (Sherer et al., 2001). However, in order for the SLP to capture enough footage of the student performing the behavior, the student must have the target behavior in his or her repertoire to some extent (with or without prompting) (Rayner et al., 2009). The amount of time the SLP may need to devote to taping the behavior for this type of video modeling is unpredictable. Once taping is completed, the SLP would edit footage from multiple tapings/settings to produce a final video that only pictures the child performing the target behavior correctly. If self-modeling is the chosen technique, the video editing expertise of and/or resources available to the SLP should be considered.

Choosing a setting. Ideally, the setting of the video model recording will be the setting in which the student is expected to perform the target skill. For example, if the SLP wants the student to point to request toys in the block center, then the video model should be recorded in the block center. This enhances the ecological validity of the intervention by picturing the real-life situation in which the target skill will be used. In addition, the real setting then becomes the stimulus to elicit the modeled behavior. Using the natural setting in this way has been shown to produce greater intervention effects as well as higher levels of skill maintenance and generalization (Bellini, Peters, Benner, & Hopf, 2007). However, within this natural setting (e.g., classroom, lunch room, playground), visual and auditory distractions should be minimized during recording so the student is able to focus on the model and the behavior(s) being modeled. For this reason, it would be best to record the video model before or after school, when other students are not present.

Just as a natural setting is important to intervention effects, all materials used in the video model should be natural, familiar, and appropriate for the behavior being modeled. Figure 1 illustrates an example of a video model that was recorded in a natural classroom setting using everyday classroom materials and with minimal visual distractions. This video model was created to target reaching to request, with the classroom teacher (left) as the model and the teaching assistant (right) as the facilitator, or interaction partner.

Scripting the video model. For optimal learning, a video model of 3–5 min is recommended (Shukla-Mehta et al., 2010), although studies have produced intervention effects with videos ranging from 35 s to >5 min (Bellini & Akullian, 2007; Nikopoulos & Keenan, 2004). To determine the optimal length of the video, the SLP may consider the student's typical attention span or may set up a trial video viewing. In addition to choosing the length of the video segment, the SLP must determine how many instances of the modeled behavior will be recorded, as well as any other scripted factors (e.g., interactions, wait time, facial expressions). There is little evidence to guide the SLP in choosing the number of instances to show; however, research has shown positive effects with video models showing six to 14 instances of the target behavior (MacDonald, Sacramone, Mansfield, Wiltz, & Ahearn, 2009; Reagon, Higbee, & Endicott, 2006). When scripting video models depicting behaviors such as play or social interaction, SLPs may choose to observe typically developing students performing

Figure 1. Screenshot of a video model targeting reaching to request.

the target behavior and base the video model's script on those interactions (Paterson & Arco, 2007).

There are a few additional factors the SLP should consider during the scripting process. For example, a video model may be created with or without voice-over narration and/or instructions for the student. Evidence for inclusion of narration is mixed, and for some students (e.g., those who have auditory sensitivity or processing difficulties), inclusion of this additional processing challenge may lessen the intervention's effectiveness (Rayner et al., 2009). The SLP will also need to decide whether to segment the target behavior into multiple video modeling steps or picture the complete behavior in one model. Additional research on the relative effectiveness of these two strategies is needed. SLPs will want to consider the characteristics of the student and determine whether a task analysis approach (i.e., breaking a skill into small, manageable steps) is preferable for promoting learning, maintenance, and generalization of the particular skill.

Phase 2: Recording of the Video Model

Once the SLP has determined the content and setting of the video model, the second phase of the video modeling process involves the actual recording of the video model. This phase entails decision making regarding the equipment for video recording and playing as well as evaluation of the recorded video model's quality.

Choosing equipment. Video recorders have become highly accessible and affordable and are even provided to some teachers, therapists, and/or schools. Small, USB-ready video cameras range in price, with the more expensive options generally producing better video and audio quality. Some video cameras will have an input for an external microphone, and this inexpensive accessory can be used to enhance audio quality if needed. If the SLP does not have access to a tripod, an affordable tabletop tripod can be purchased. Most USB-ready video cameras include easy-to-use software packages that allow for uploading, sharing, and, in some cases, editing of videos. More comprehensive video editing software can be purchased if, for instance, the SLP wishes to use video self-modeling with a student. Additional information regarding resources and equipment for professionals incorporating video modeling into their practice may be found in the user-friendly and widely accessible book titled *How to Use Video Modeling and Video Prompting* (Sigafoos, O'Reilly, & de la Cruz, 2007).

In addition to the items needed to create the video model, certain equipment is needed to present the video model to the student. Video models can be played for students on a classroom computer (e.g., desktop, laptop, tablet PC), television, or portable computer from outside the classroom. These items are generally available to school staff and are purchased by the school. SLPs without access to the needed equipment may want to consider partnering with teachers and administrators to apply for outside grant money to purchase the needed technology. Although a focus on grant resources is beyond the scope of this article, an Internet search using combinations of key words such as *grant, school, education, special education, autism*, and *technology* will lead to information about current grant competitions. One index of current educational technology grant opportunities can be found under the "Grants Index" tab at http://technologygrantnews.com/technology-funding.html.

Evaluating video and audio quality. SLPs using video models in their practice will need to evaluate the quality of the recording before presenting it to the student. Not only does the modeled behavior need to be clearly visible and the focus of the video, but distractions should be minimized. Adults who are accustomed to "tuning out" the ambient noises of a school setting may not notice distractions that seep into the video recording. For example, a loudspeaker announcement, a favorite toy visible in the background, or a child walking behind the scene is likely to reduce the effectiveness of the intervention by distracting the student away from the salient behaviors of the model. A grainy or jumpy video may also sidetrack the student and provide extraneous sensory input that similarly distracts from the modeled behavior.

For some target behaviors, such as simple play and gestural requests, the audio component of the video model may be less important; for other target behaviors, such as conversation or greetings, the quality of the audio is of utmost importance. SLPs should evaluate the quality of the video model's audio output by playing the video on the

actual device that will be used to display the video to the student. This is important because not all video players will produce the same audio, and the SLP must determine whether the student will be able to adequately hear and decipher the audio component of the video model.

Before implementation, the SLP may wish to create and use a checklist to systematically evaluate the video model's quality and adherence to the intended script (e.g., number of models, scripted phrases or actions, length). This tool can be viewed as a measure of fidelity of the intervention. Table 4 provides possible items to include in the checklist.

Phase 3: Implementation of the Video Modeling Intervention

Once the video model has been recorded, evaluated for adherence to quality and fidelity guidelines, and possibly rerecorded, the SLP is ready to implement the video modeling intervention. Phase 3 involves decision making surrounding the details of the video modeling implementation, including determination of the setting, frequency, and timing of video viewing as well as the person(s) who will implement the intervention plan.

Determining setting and frequency of viewing. Before implementing the video modeling intervention, the SLP will need to determine an appropriate setting in which the student will watch the video model. As much as possible, this setting should be free of distractions (e.g., loud noises, other children, music). The SLP may find that his or her office is the ideal location for the student to view the video model; otherwise, a desk in a quiet corner of the classroom, the hall, another empty classroom, or the library may work well. The student may wear headphones to reduce auditory distraction; however, some students with ASD may find the sensation of headphones aversive.

Similarly, the SLP will want to determine the frequency of video model viewing for each student. This guideline may be altered along the way using the SLP's clinical judgment, but determining the expected frequency at the start of therapy may help to structure and schedule the intervention in consideration of the student's many other classroom and therapy commitments. Research suggests that repeated viewing (e.g., two to four times per session) of a video model increases intervention effects for some children with ASD (Shukla-Mehta et al., 2010); however, the length of the video segment and attention span of an individual student can guide the SLP in determining the optimal frequency of viewing.

Determining timing of viewing. The goal(s) of the intervention and the characteristics and skills of each student will guide the timing of the video model viewing. For example, the SLP may wish to show the video model to some students immediately before the event during which the student is expected to use the modeled behavior. As stated in the introduction, this can be conceptualized as a type of priming because exposure to the video model will hopefully alter the student's response to the later stimulus. Some researchers even refer to video modeling as *video priming* (Cihak et al., 2010; Odom et al., 2003), whereas others similarly conceptualize video modeling as a setting event for the target behaviors (Simpson et al., 2004). Alternately, or maybe later in the intervention process, the SLP may wish to show the video model to a student at a time that is temporally removed from the situation when the behavior is expected. This method may be preferable if the SLP wishes to target learning, as opposed to immediate imitation, of the modeled behavior, or if the SLP is assessing the student's potential for maintenance and generalization of the skill. However, as of yet, there are no specific data to guide SLPs in this decision.

Determining who will implement the intervention. Once a video model has been created, implementation is straightforward. The SLP will have previously determined the student's ability to sit and attend to a video. Because the determined timing of the viewing may preclude the SLP from implementing the intervention, he or she may provide the adult who implements the intervention with instructions regarding the timing and location of viewing, number of repetitions of viewing in one sitting, and whether/how the

Table 4. Sample checklist of video, audio, and overall quality items.

Video quality	*Audio quality*	*Overall quality*
☐ Is the video clear (vs. grainy or pixelated)?	☐ Is the audio clear (vs. with echo or double sound)?	☐ Does the video model generally follow the script?
☐ Does the video play smoothly (vs. jumpy or halting)?	☐ Does the audio sync with the video (vs. with delay or mismatch)?	☐ Does the length of the video model match the intended length?
☐ If video editing was used, are the transitions clean/seamless (or nearly so)?	☐ Is the audio easy to decipher (vs. muted or overly quiet)?	☐ Does the video model display the intended number of modeled behaviors?
☐ Is the model the focus of the video, with his/her actions clearly visible?	☐ Is the audio free of distracting sounds (e.g., announcements, other conversation, air conditioner hum)	☐ Are the setting and materials used in the video model natural to the student and the target behavior?

adult should prompt/redirect the student to attend to the video as needed. With these instructions and basic knowledge of the equipment used (e.g., computer, headphones), a classroom staff member (e.g., teaching assistant, teacher, program aide) or caregiver could implement the video modeling intervention with minimal time commitment or training (Delano, 2007).

Phase 4: Monitoring of Student's Response to the Video Modeling Intervention

During and following video modeling implementation, the SLP will want to monitor each student's progress in response to the intervention. Thus, Phase 4 involves planning for data collection, including promoting and evaluating generalization and maintenance of gained skills.

Choosing methods of data collection. School-based SLPs use varied means of data collection to monitor student progress. In line with their overall responsibility to monitor progress collaboratively with other professionals and, when appropriate, the student (ASHA, 2010), SLPs will need to develop a plan for collecting data on the effectiveness of the video modeling intervention. This progress monitoring plan may include certain standardized or nonstandardized assessment procedures, allowing for pre-, mid-, and post-treatment comparisons (see suggestions for assessment tools in the section on choosing an appropriate target skill). The assessment of progress should be tailored to the outcomes that the video modeling is designed to impact. One consideration in planning progress monitoring is that few standardized tests will be sensitive to changes in specific targeted behaviors over a short period of time. If scores from a standardized instrument are deemed appropriate as criteria to monitor progress, the SLP must be cognizant of the frequency of administration recommended for each assessment (e.g., once every 6 months due to potential testing effects), which is generally stated in the test manual.

Another option for progress monitoring is behavioral observation (Kennedy, 2002), which allows for more contextually based examination of a student's progress and can be used on its own or in combination with other progress monitoring methods. The SLP may use a predetermined criterion to gauge progress based on a student's developmental level and goals or ask others on the educational team to assist in observational data collection. Observational data collection forms can be created that indicate the student's target behavior and any other instructions necessary to ensure that team members collect data in a consistent manner (see the Appendix for a sample observation form). Observations should occur in natural contexts during times when the target behavior is appropriate and expected. To ensure the representativeness of the student's performance, observations should also be conducted over multiple days.

If appropriate, students may play a role in the data collection process by self-monitoring their use of the target behavior (see example of use in Strain, Kohler, Storey, & Danko, 1994). For example, a middle school student with ASD may apply a sticker to a chart on the wall each time he or she initiates an interaction with a peer. In this way, data collection can become a reinforcer for the student while also promoting the student's independence. As a final consideration for data collection, the SLP may wish to assess the impressions of the educational team in regard to the intervention. Tools such as the Intervention Rating Profile—15 (Witt & Martens, 1983) are quick and easy to use and can assess team members' impressions of video modeling's acceptability and practicality as a school-based intervention. Sample items from the Intervention Rating Profile—15, rated on a six-point Likert-type scale, include: "I would be willing to use this intervention in the classroom setting"; "this intervention would be appropriate for a variety of children"; and "I would suggest this intervention to other professionals."

Promoting and evaluating generalization and maintenance of skills. *Generalization* refers to students' ability to use a target skill in different settings, with different people, and with different materials/stimuli; *maintenance* refers to students' retention of the learned behavior over time. Video modeling has been shown to produce effects that are both generalized and maintained by individuals with ASD (Bellini & Akullian, 2007; Nikopoulos, 2007). With as few as three video modeling sessions, gains have been shown to generalize across settings, people, and stimuli (Nikopoulos & Keenan, 2004). In addition, acquired skills have been found to maintain for as many as 15 months following video modeling intervention (Charlop & Milstein, 1989).

Both generalization and maintenance can be promoted by using a student's familiar classroom setting and materials in the intervention (Bellini et al., 2007). In addition, SLPs may promote generalization by introducing video footage from a variety of familiar settings (e.g., library, cafeteria, classroom; Mechling, 2005) and with a variety of materials and interaction partners. In order to promote maintenance, one study showed that breaking target behaviors into smaller steps (i.e., task analysis) increased maintenance of skills and reduced prompt dependency (Sigafoos, O'Reilly, Cannella, et al., 2007). Although the Sigafoos, O'Reilly, Cannella, et al. (2007) study employed adult participants and targeted adaptive goals (i.e., dish washing), this method may also be useful for younger individuals who are working to gain social and communication skills. More research is needed to determine a greater variety of strategies for promoting generalization and maintenance of various skills learned through video modeling (Rayner et al., 2009).

Ongoing evaluation is necessary to determine the breadth and depth of a student's mastery of targeted skills. Both during and following the video modeling treatment, the SLP may use assessments and/or structured observations to determine whether the student has effectively incorporated target behaviors into their skill repertoire and is able to

use the skills flexibly across settings, people, and materials. Such evaluation is appropriate as little as 1 week following treatment and can be continued for a number of months as a means of assessing the long-lasting impacts of the intervention.

Phase 5: Planning of Next Steps

After evaluating the effects of the video modeling intervention on a particular student, the SLP will be ready to make decisions regarding the next steps for intervention. Such decisions must be made whether or not the student responds well to the video modeling intervention.

Next steps if video modeling is effective. If a student responds to the video modeling intervention by showing gains in the target skill, the SLP may wish to expand on the current target skill by recording a new video model with similar characteristics. For example, if the student responded to the first video model by gaining the target skill of requesting by pointing, the subsequent video model could target the combination of vocalization and pointing to request. In this way, the SLP could continue to use video modeling to build the student's skills in small developmental steps. Alternatively, if the student gained the target skill but had difficulty generalizing or maintaining the skill, next steps could include variations of the methods described in the final section of Phase 4.

Modification options if video modeling is not initially effective. If a student is making little or no progress through a video modeling intervention, the SLP may wish to modify the intervention to better accommodate the individual student's preferences, strengths, and needs. Some students may have the ability to describe what about the video model is unappealing or difficult for them to process; however, for the majority of students with ASD, the SLP will have to use his or her clinical judgment and consultation with team members to form educated hypotheses regarding potential roadblocks. For example, some students may have very specific preferences and aversions when it comes to interaction partners or instructors. If such a student appears uninterested in the actions of the individual modeling the behavior in the video, the SLP may rerecord the video using a different model type (e.g., peer, sibling, preferred adult). Other students may have difficulty processing multimodal information in a video model that involves both visual and auditory input. For these students, the SLP may wish to reduce the information load by muting the video and picturing behaviors that do not require an auditory component (e.g., gestures, nonverbal play sequences). Should a student continue to have difficulty processing the information provided by the video model, the SLP may choose to shorten the video model or rerecord the video using a slower pace of movement, which is a strategy that has been used successfully with some school-age children with autism (Charlop & Milstein, 1989; Charlop-Christy et al., 2000). Additional modifications could be made to the setting in which the child views the video model, the frequency of viewing, and/or the inclusion/exclusion of accompanying prompting and instructional procedures.

Alternative intervention options if video modeling is not effective. Video modeling will not be effective for all students with ASD. Aside from offering guidelines for broad skills linked to success (e.g., imitation skills, ability to visually attend), the existing research does not offer more specific predictors for success with this intervention and does not outline specific timelines or criteria to define success with video modeling. Instead, SLPs will have to use their clinical judgment and individualized decision making to determine when to move on and consider alternative intervention strategies for a student. Fortunately, if a variety of modifications to the video model have been attempted with no positive response, there are other supplementary intervention options that the SLP and educational team can explore. Additional interventions that are practical and that promote independence in students with ASD include self-monitoring strategies and individual work systems (Hume et al., 2009). Other intervention strategies that have been found to increase socialization in school-age children with ASD include peer-mediated strategies (e.g., peer tutors, circle of friends), social skills groups (Rogers, 2000), and social stories (Gray & Garand, 1993). Cognitive picture rehearsal (Groden & LeVasseur, 1995) is another empirically supported strategy that is a simpler (in terms of story structure and ease of creation) alternative to social stories. Finally, if a student seems to be unresponsive to the video component of the video modeling intervention (e.g., becomes uninterested over time, seems to focus only on nonsalient features), a live version of the modeling intervention could be attempted (alone or in combination with video modeling).

Conclusion

The everyday challenges faced by school-based SLPs are many, and video modeling speaks to those challenges in the following ways: (a) Video modeling meets evidence-based practice requirements as empirically supported; (b) video modeling requires very little training and proficiency to be implemented by professionals; (c) video modeling can be used with great consistency across settings, materials, and team members; (d) video modeling is rewarding to many students with ASD and, thus, may curb behavior problems; and (e) video modeling is affordable, with creation of a video model costing less in time and resources than, for example, in-vivo modeling (Charlop-Christy et al., 2000). This tutorial outlines the rationale for school-based SLPs' use of video modeling with students with ASD and provides clear systematic instructions for implementation. By following these steps and incorporating the supplemental intervention strategy of video modeling into their practice when appropriate, school-based SLPs can have great potential to

effect lasting change in the social, communication, adaptive, self-regulatory, and play skills of their students with ASD.

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APPENDIX. SAMPLE OBSERVATIONAL DATA COLLECTION FORM

Student's name:_____ **Date:**_____ **Time:**_____ **Observer:**_____

Goal: During preferred games/routines, after a brief pause, the child will use a gesture to indicate that s/he wants the game to continue.

Operational definition: After a brief (adult-created) pause in a game/routine, the student will indicate his/her desire for the game/routine to continue through the use of one of the following gestures: signing "more," reaching (without grabbing, so hand stays open and is retracted), or pointing.

Instructions: During a **5-minute observation**, the observer should place a check in successive boxes for each observation of the behavior defined above.

Context:_____	**Context**:_____
☐ 1	☐ 1
☐ 2	☐ 2
☐ 3	☐ 3
☐ 4	☐ 4
☐ 5	☐ 5
☐ 6	☐ 6
☐ 7	☐ 7
☐ 8	☐ 8
☐ 9	☐ 9
☐ 10	☐ 10
☐ 11	☐ 11
☐ 12	☐ 12
☐ 13	☐ 13
☐ 14	☐ 14
☐ 15	☐ 15
☐ 16	☐ 16
☐ 17	☐ 17
☐ 18	☐ 18
☐ 19	☐ 19
☐ 20	☐ 20