Video Modeling Interventions to Improve Play Skills of Children with Autism Spectrum Disorders: A Systematic Literature Review

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Abstract Children with autism spectrum disorders (ASD) often experience substantial delays in developing appropriate play skills. Video modeling interventions have been successfully used to teach new skills with this population (Shukla-Mehta et al. in *Focus on Autism and Other Developmental Disabilities*, 25, 23–36 2010). This paper reviews video modeling studies that included children with an ASD and measured a form of engagement in play as one of the dependent variables. Twenty-two studies ($n=57$ children) were identified and divided into two categories: solitary and social play. The results indicated that video modeling is an effective intervention to teach various play-related skills. Similarities across intervention methodology are discussed in order to provide general guidelines for the design and use of video modeling interventions. Maintenance and generalization results are also highlighted. Finally, several areas for future research are considered.

Keywords Autism spectrum disorders · Video modeling · Play skills · Literature review

Although there is not a precise definition of play, experts agree that it is a complex, often intrinsically motivated activity characterized as spontaneous, flexible, and creative in nature (Mastrangelo 2009). Play is an important activity for young children to engage in because it is linked to social, cognitive, physical, and emotional development. It also provides the context in which children explore and learn how to interact with the surrounding environment (Ginsburg et al. 2007). For

example, children may be introduced to skills such as perspective taking or emotional regulation that are foundational to developing relationships with peers (Frost et al. 2005; Ginsburg et al. 2007). However, children with autism spectrum disorders (ASDs) often do not develop appropriate play behaviors on their own. They may instead engage in rote, repetitive, or stereotypic nonfunctional play such as lining up toys (American Psychiatric Association 2013; Baron-Cohen 1987; Wulff 1985). Additionally, global difficulties in imitation, expressive and receptive communication skills often complicate the development of appropriate play. These challenges are often pervasive without intervention.

There are a number of behavioral interventions used to target play skills with children with ASDs. These include pivotal response training, reciprocal imitation training, differential reinforcement, in vivo modeling, play scripts, video modeling and milieu training (Stahmer et al. 2003; Terpstra et al. 2002; Lang et al. 2009). Video modeling, in particular, is a popular intervention used with individuals with ASDs to teach a variety of new skills. During video modeling, the individual watches a video of a person (or persons) modeling the desirable behaviors and then is asked to imitate the video (Banda et al. 2007; McCoy and Hermansen 2007). There are a number of literature reviews published on the use of video modeling interventions with individuals with autism or other developmental disabilities (Rayner et al. 2009; McCoy and Hermansen 2007; Shukla-Mehta et al. 2010). For example, McCoy and Hermansen (2007) reviewed the impact of the type of model used in the video (e.g., peer, adult or a mix of the two) on the effectiveness of acquisition of behaviors targeted through video modeling. Shukla-Mehta et al. (2010) reviewed the effects of various video types such as video modeling, video self modeling

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and point of view video modeling on social and communication skills training. Collectively, these reviews indicate that video modeling is an effective, versatile intervention for individuals with ASDs. However, a literature review on video modeling as an intervention to improve play skills for this population has not, to our knowledge, yet been published.

The primary purpose of this review is to identify, analyze, and summarize research on video modeling interventions used to improve play-related behaviors for children with ASDs. Reporting this information serves to extend the literature base by providing a more comprehensive view of video modeling as an intervention, identify the common characteristics of the studies and general effectiveness specifically for play outcomes.

Method

Search

An electronic database search was conducted using three databases: PsycINFO, Psychology and Behavioral Sciences Collection, and Education Resource Information Center (ERIC). The terms *video model*(or video based or video instruction)* were entered in the first search field, *play (or leisure or toys or pretend or recreation)* entered in the second field and *autism (or autistic)* entered in the third search field. The search was limited to entries up to and including the year 2013, published in the English language and in peer-reviewed journals and gave an initial 104 results. After duplicates were removed, there were 96 total entries. Criteria were applied in order to determine which articles would be included or excluded in the review.

Inclusion-Exclusion Criteria

To be included, the study must have met several inclusion criteria. First, the study must have involved at least one participant with an ASD up to and including 12 years of age. Second, the intervention included a video modeling component. Video modeling was defined as a process in which the participant observed a video of a model (e.g., self or another person) engaging in a target behavior and then was expected to imitate the behavior. Third, the study needed to include objective empirical data in which the effects of video modeling on play were measured. Fourth, studies must have reported play behavior as a dependent variable. Use of play as a context to teach skills without including a measure of play was excluded. For example, some researchers measured social initiations during play (e.g., Buggey et al. 2011; Kroeger et al. 2007) or used toys as props for

conversational speech but did include any data or measurement of play behaviors (Charlop and Milstein 1989; Charlop et al. 2010; Gena et al. 2005). Twenty-two studies met the inclusion criteria. Table 1 provides a summary of each included study.

Coding and Summary of Studies

Studies that met the inclusion criteria were coded using a computerized data sheet specifically designed for this review. Each article was read and pertinent information extracted and recorded on the data sheet. Each study was classified into one of two possible categories based on the type of play, solitary play or social play. Studies were categorized as solitary play if the video showed one person playing or focused on increasing play behaviors of the participant playing alone. Studies were categorized as social play if the video model targeted improving play behaviors of the participant with one or more people. Once categorized, each study was summarized according to the following features (see Table 1): (a) participant characteristics (e.g., sex, diagnosis, age); (b) targeted skills (dependent variables); (c) intervention components; (d) outcomes; (e) maintenance and generalization. For each play-related dependent variable, results were reported as positive, negative or mixed in studies utilizing single-case experimental designs (Lancioni et al. 1996; Lang et al. 2012) and positive or negative in studies utilizing group design. For studies utilizing single-case experimental designs, results were classified as positive if visual analysis of the graphed data indicated improvement for all participants, negative if no improvements were apparent or minimal improvements were made (as described by authors) for all participants, and mixed if improvements for the dependent variable occurred for some, but not all participants in the study. For studies utilizing group design, results for each dependent variable were classified as positive if statistically significant improvements were reported and negative if statistically significant improvements were not reported. For maintenance and generalization results, positive results meant that the gains in play behavior remained above baseline levels for all participants whereas negative results indicate no improvements. Mixed results indicate improvement for some but not all participants. Positive, negative and mixed results were represented in Table 1 with “+”, “−”, and “+/-” respectively.

From this search, 22 studies ($n=57$ children) were identified and included. The majority of the participants were boys ($n=49$ or 86 %). The average age of the participants was 6 years old (range 2.5 to 15 years of age). Most of the studies (95 %) utilized a single subject design to determine effectiveness of the video model intervention. Sixteen studies (73 %)

Table 1 Summary of reviewed studies

Study citation	Participants	Targeted skills	Intervention components	Results	Maintenance and generalization
Solitary play					
Boudreau and D'Entremont (2010)	2 boys; PDD-NOS ^a ; 4 years, 1 month	Play actions and verbalizations (scripted and unscripted)	<ul style="list-style-type: none"> • VM^b: adult modeled 71 to 75 s of scripted play with veterinary and construction sets • Sessions conducted across phases: VM only, VM plus reinforcement, and reinforcement without any videos 	Scripted play actions and verbalizations (+) Unscripted play actions and verbalizations (–)	<i>Maintenance</i> 1 week (+) 4 weeks (+/–) <i>Generalization</i> Novel toys: • scripted behaviors (+) Different setting: • scripted behaviors (+)
D'Ateno et al. (2003)	1 girl; autism; 3 years, 8 months	Play actions and verbalizations (scripted and unscripted)	<ul style="list-style-type: none"> • VM: adult modeled 10–12 play behaviors each for tea party, shopping, and baking themed toys • Minimum 1 h delay between presentation of VM and presentation of play materials 	Scripted actions and verbalizations (+) Unscripted actions and verbalizations (–)	<i>Maintenance</i> Not reported <i>Generalization</i> Not reported
Dauphin et al. (2004)	1 boy; autism and ADHD ^c ; 3 years old	Play actions and verbalizations (scripted)	<ul style="list-style-type: none"> • VM: Short video clips embedded within computerized schedule of activities of 8-year old boy modeling a verbal sentence and play action with toy figure. • Corrective prompt procedure 	Scripted play actions and verbalizations (+)	<i>Maintenance</i> 3 weeks (+) 3 months (–/+) <i>Generalization</i> Scripted statements and actions combined in novel sequences (+)
Dupere et al. (2013)	1 girl, 2 boys; autism; 5 and 6 years old	Play actions and verbalizations (scripted)	<ul style="list-style-type: none"> • VM: adult modeled 15 actions, 14–16 vocalizations with embedded substitutable loops across three toy sets • Substitutable loops were sections of script that could be substituted with other characters (1–9 actions, 3–8 vocalizations) • Three trained and three untrained characters for each toy set • VM: adult's hands modeled play actions with gardening or cooking themed sensory play materials for less than 2-mins • General reinforcement for staying at bin with toys (not contingent on play actions) • 3-min practice sessions with toys after video viewing 	Scripted play actions and verbalizations (+)	<i>Maintenance</i> Follow-up probes (+; length of time not reported) <i>Generalization</i> Untrained characters: • scripted actions and verbalizations (–/+) Different setting: • Trained characters (+) • Untrained characters (–/+) <i>Maintenance</i> (+) <i>Generalization</i> Novel, related materials (+/–) Classroom setting (+/–)
Hine and Wolery (2006)	2 girls; autism; 2 years, 6 months and 3 years, 7 months	Play actions with sensory materials		Play actions (+)	

Table 1 (continued)

Study citation	Participants	Targeted skills	Intervention components	Results	Maintenance and generalization
Lydon et al. (2011)	5 boys; autism; 3–6 years old	Play actions and verbalizations (scripted)	<ul style="list-style-type: none"> Adapted procedure for one participant: practice sessions with prompts and reinforcement (FR 1st) PRT^c vs VM VM: 12 scripted verbalizations and actions with toy figurines (90 s) 	<ul style="list-style-type: none"> Play actions Within group: PRT (+) VM (+) Between group: PRT vs VM (-) Play verbalizations Within group: PRT (-) VM (-) Between group: PRT vs VM (-) 	<p><i>Maintenance</i></p> <p>Play actions (+)</p> <p><i>Generalization</i></p> <p>Different settings:</p> <ul style="list-style-type: none"> Play actions <p>Within group:</p> <p>PRT (+)</p> <p>VM (-)</p> <p>Between group:</p> <p>PRT > VM</p> <ul style="list-style-type: none"> Play verbalizations: <p>Within group:</p> <p>PRT (-)</p> <p>VM (-)</p> <p>PRT vs VM (-)</p>
MacDonald et al. (2005)	2 boys; autism; 4 and 7 years old	Play actions and verbalizations (scripted and unscripted)	<ul style="list-style-type: none"> VM: Adult modeled 16 actions and 14 verbal statements with town, ship and house themed toys 	<ul style="list-style-type: none"> Scripted actions and verbalizations (+) Unscripted play (-) 	<p><i>Maintenance</i></p> <p>Follow-up probes (+; length of time not reported)</p> <p><i>Generalization</i></p> <p>Not reported</p>
Palechka and MacDonald (2010)	2 boys and 1 girl; autism; 4–5 years old	Play actions and verbalizations (scripted)	<ul style="list-style-type: none"> Comparison between the VM or instructor created videos (ICVs) vs commercially available videos (CAVs) VM: two adults modeled scripted play sequence lasting about 2 min, 40 s long with toy figurines 	<p>Scripted play</p> <p>ICV (+)</p> <p>CAV (-)</p>	<p><i>Maintenance</i></p> <p>Follow-up probes (+; length of time not reported)</p> <p><i>Generalization</i></p> <p>Not reported</p>
Paterson and Arco (2007)	2 boys; autism; 6–7 years old	Play actions and verbalizations (appropriate and repetitive)	<ul style="list-style-type: none"> VM: Young male modeled 2 min scripted play with theme related sets of toys vs unrelated sets of toys Prompts for attending and praise provided once during each session for appropriate play behaviors Comparison between “simultaneous” (with supplementary instruction during training of scripts) vs “traditional” (without instruction during training of scripts) 	<p>Appropriate play actions and verbalizations</p> <ul style="list-style-type: none"> related (+) unrelated toys (+) 	<p><i>Maintenance</i></p> <p>1 week (+)</p> <p><i>Generalization:</i></p> <p>Novel, related toys (+)</p> <p>Novel, unrelated toys (-)</p>
Sancho et al. (2010)	1 boy and 1 girl; autism; 5 years, 4 months and 5 years, 11 months	Play actions and verbalizations (scripted and unscripted)		<p>Scripted play actions and verbalizations</p> <ul style="list-style-type: none"> Simultaneous (+) Traditional (+) <p>Unscripted actions and vocalizations (-)</p>	<p><i>Maintenance</i></p> <p>1 week (one participant; +)</p> <p>2 weeks (one participant; +)</p> <p><i>Generalization (novel, similar toys)</i></p> <p>Scripted</p> <ul style="list-style-type: none"> play actions (+)

Table 1 (continued)

Study citation	Participants	Targeted skills	Intervention components	Results	Maintenance and generalization
Schefflen et al. (2012)	4 boys; autism; 3 years, 1 month to 5 years, 9 months	Developmental play level and MLU ^f	<ul style="list-style-type: none"> • VM: adult's hands modeled 2 min with circus and house themed play sets • VM: adult's hands modeled three sequences (30 s) on a specific developmental play level • Verbal praise for imitated actions 	Developmental play level (+) MLU (+)	<ul style="list-style-type: none"> • verbalizations (+/-) Unscripted • play (-) • verbalizations (-) <i>Maintenance</i> Developmental play level (+) MLU (+) <i>Generalization</i> Setting • play level (+) • MLU (+) <i>Maintenance</i> Not reported <i>Generalization</i> Novel setting (+)
Tereshko et al. (2010)	4 boys; autism; 4–6 years old Construction of toy figurines		<ul style="list-style-type: none"> • VM: adult's hands modeled 8-step sequence of building Mega Bloks[®] monster characters • modified procedure (segmented video) used for participants who did not respond to full sequence video • Edibles provided regardless of performance at end of session • Response block procedure implemented for repeated errors, but no other instructions or prompts were given 	Full sequence video (+/-) Segmented video (+)	<i>Maintenance</i> Not reported <i>Generalization</i> Novel setting (+)
Social play Charlop et al. (2008)	2 boys; autism; 8 and 9 years old	Play behaviors (Parallel play, interactive play, nonverbal initiations and responses)	<ul style="list-style-type: none"> • VM: Two adults modeled scripted conversations of 3–4 exchanges about toys • Free play sessions were conducted bi-monthly in which play behaviors were assessed 	Play behaviors (+/-)	<i>Maintenance</i> Not reported <i>Generalization</i> Across persons (+/-)
Kleeberger and Miranda (2010)	1 boy; autism; 4 years and 4 months	Imitation of play activities	<ul style="list-style-type: none"> • VM: 3–4 min of adult “teacher” leading two adults “children” in imitating play actions (baby doll, carnival, and construction play sets) • Prompts and reinforcement systematically added 	VM (-) Addition of highlighting, prompting and reinforcement (+)	<i>Maintenance</i> Not reported <i>Generalization</i> : Untrained stimuli (+) Novel person/setting (+)
MacDonald et al. (2009)	2 boys; autism; 5 and 7 years old	Play actions and verbalizations (scripted and unscripted), reciprocal verbal interaction chains, and cooperative play with peers	<ul style="list-style-type: none"> • VM: Two adults modeled 14–17 scripted play actions and statements each of zoo, airport or play grill schemes 	Scripted actions and verbalizations, reciprocal interaction chains and cooperative play (+) Unscripted play (+/-)	<i>Maintenance</i> Not reported <i>Generalization</i> : Not reported

Table 1 (continued)

Study citation	Participants	Targeted skills	Intervention components	Results	Maintenance and generalization
Maione and Miranda (2006)	1 boy; autism; 5 years 7 months	Verbalizations (scripted, unscripted, initiations, and responses to peers)	<ul style="list-style-type: none"> Both participant and peer partner viewed VM VM: Two adults modeled between 70 to 87 s of scripted play each with playdoh food making set, cars, tree house themed toys systematic addition of video feedback and prompting (visual and verbal) 	VM: Scripted and unscripted verbalizations (+), initiations (-) Responses to peers (-) Additional video feedback and prompting: Scripted and unscripted verbalizations, initiations, responses to peers (+) Social initiations (+/-) Appropriate play (+/-)	<i>Maintenance</i> 7, 16, 18 days after intervention (+) <i>Generalization</i> Not reported
Nikopoulos and Keenan (2003)	6 boys, 1 girl; autism, MR, ADHD; 9–15 years old	Social initiations and appropriate play	<ul style="list-style-type: none"> VM: 35 s video of peer initiating play with an adult Modified intervention (VSM[®]) for participant who did not initially respond to VM 	<i>Maintenance</i> 1 month (+/-) 2 months (+) <i>Generalization</i> Different setting (+) Different peer (+) Different toy (+/-) However, baseline generalization probes not reported.	<i>Maintenance</i> 1 month (+) 3 months (+) <i>Generalization:</i> Novel toys: Reciprocal play (+) Social initiations to play (+)
Nikopoulos and Keenan (2004)	3 boys; autism; 7–9 years old	Social initiations to play and reciprocal play	<ul style="list-style-type: none"> VM: peer modeled initiation towards adult model to play (i.e., “Let’s play”, taking adult’s hand and playing for 15 s). Simplified version consisted of initiation only. A simplified version of the video was provided if social initiations did not occur. 	Reciprocal play (+) Social initiations to play (+)	<i>Maintenance</i> 1 month (+) 3 months (+) <i>Generalization:</i> Novel toys: Reciprocal play (+) Social initiations to play (+)
Nikopoulos and Keenan (2007)	3 boys, 1 girl; autism; 6–7.5 years old	Social initiations, reciprocal and imitative play	<ul style="list-style-type: none"> VM: peer modeled initiation towards adult model to play, additional videos added engagement in activities General praise and edibles were provided during breaks between consecutive sessions VM: Two adults modeled scripted play (17–21 play behaviors) as specific characters in store, school and hospital scenarios Small group training consisted of verbal feedback, prompts, and reinforcement. VM: Sibling and peers modeled 4–7 scripted play (actions and statements) 	Social initiations (+) Reciprocal play (+) Imitative play (+)	<i>Maintenance</i> 1 month (+) 2 months (+) <i>Generalization:</i> peer (+) <i>Maintenance:</i> 2 weeks (+) <i>Generalization</i> Not reported
Ozen et al. (2012)	3 boys; autism; 9 years old	Sociodramatic role play	<ul style="list-style-type: none"> Small group training consisted of verbal feedback, prompts, and reinforcement. 	Sociodramatic role play (+)	<i>Maintenance:</i> 2 weeks (+) <i>Generalization</i> Not reported
Reagon et al. (2006)	1 boy; autism; 4 years old		<ul style="list-style-type: none"> VM: Sibling and peers modeled 4–7 scripted play (actions and statements) 	Scripted actions and verbalizations (+)	<i>Maintenance</i>

Table 1 (continued)

Study citation	Participants	Targeted skills	Intervention components	Results	Maintenance and generalization
Taylor et al. (1999); study 1	1 boy; autism; 6 years old	Play actions (scripted) and verbalizations (scripted and unscripted)	with firefighter, cowboy, teacher or doctor dressup costumes <ul style="list-style-type: none"> Both participant and sibling viewed VMs Sibling said the scripted lines no matter the participant's play behavior VM: Sibling and adult modeled conversation (six scripted statements) using airplane, picnic or dinosaur cars toys verbal praise and tangibles for scripted or unscripted commenting 	Unscripted verbalizations (–)	Scripted play actions and verbalizations (+) <i>Generalization</i> Setting/play partner (+) However baseline probes not reported.
study 2	1 boy; autism; 9 years old	Verbalizations (scripted and unscripted)	<ul style="list-style-type: none"> VM: scripted play (10 verbalizations) for adult model only (sibling not provided =with script) using batman colorforms, cars track or marines toys Forward chaining contingent verbal praise and tangibles for scripted or unscripted commenting 	Scripted verbalizations (+) Unscripted verbalizations (–)	<i>Maintenance</i> Not reported <i>Generalization</i> : Not reported

^a *PDD-NOS* pervasive developmental disorder-not otherwise specified^b *VM* video model^c *ADHD* attention deficit hyperactivity disorder^d *FRJ* fixed ratio 1^e *PRT* Pivotal Response Theory^f *MLU* mean length of utterance^g *JSM* video self modeling

percent of studies reported maintenance results. Fifteen studies (68 %) reported generalization results.

Results

Solitary Play

Twelve studies ($n=31$ children) targeted play skills involving only the participant (Boudreau and D'Entremont 2010; D'Ateno et al. 2003; Dauphin et al. 2004; Dupere et al. 2013; Hine and Wolery 2006; Lydon et al. 2011; MacDonald et al. 2005; Palechka and MacDonald 2010; Paterson and Arco 2007; Sancho et al. 2010; Tereshko et al. 2010; Schefflen et al. 2012). The average age of the participants was 4 years, 2 months (range 2.5 to 7 years). Three studies (Hine and Wolery 2006; Schefflen et al. 2012; Tereshko et al. 2010) targeted functional play (e.g., using play items in the way they were intended to be used such as using a spoon to scoop play food into a bowl). One study targeted both functional and pretend play skills (Schefflen et al. 2012). The remaining studies targeted sociodramatic play, a type of pretend play in which the children take on characters or roles and act out real-life experiences, fantasy, and drama scripts. In almost all of the studies in this category, the model was an adult. Boys who were of similar age to the participants were the models in the remaining two studies (Dauphin et al. 2004; Paterson and Arco 2007). Six studies reported the length of the video model, which ranged from 71 to 160 s (Boudreau and D'Entremont 2010; Hine and Wolery 2006; Lydon et al. 2011; Paterson and Arco 2007; Sancho et al. 2010; Schefflen et al. 2012). Three studies reported number of actions or verbalizations depicted in the video rather than duration of the video, and ranged from 10–16 scripted play behaviors (D'Ateno et al. 2003; Dupere et al. 2013; MacDonald et al. 2005).

MacDonald et al. (2005) used video modeling to teach two boys with autism, 4 and 7 years old, play scripts using figurines and objects of town-, ship-, and house-themed toy sets. Four dependent variables were measured: scripted play actions, unscripted play actions, scripted verbalizations, and unscripted verbalizations. Scripted play actions consisted of motor responses that matched the actions of the video model and resulted in the same change in the environment. These actions included moving the toy figurines as if they were engaged in specific actions (e.g., making the figurine open the door of the play house). Scripted verbalizations were single words or short phrases that matched (or were similar enough) to the statements in the video model. Unscripted actions and verbalizations were motor and verbal responses that did not match the video model. Researchers videotaped an

adult acting out each play sequence consisting of approximately 14 pretend play actions and 16 verbalizations. After viewing the video, participants were given a 4-min opportunity to play with the toys shown in the video. Both children demonstrated increases in scripted actions and verbalizations and learned to appropriately manipulate the characters and talk for them. Prior to video modeling, some unscripted play occurred but were anecdotally characterized as repetitive and unrelated to any storyline or thematic play (e.g., having a character going up and down the stairs repeatedly). After video modeling was implemented, unscripted actions and verbalizations did not occur.

Palechka and MacDonald (2010) compared the use of instructor created videos (ICV) and commercially available videos (CAV) with three children with autism, ages 3–5 years old. The CAV format consisted of a stop motion clay animation of the script in which the characters appeared to be moving by themselves while the ICV showed an adult modeling the script using the figurines and play set. The ICV was made to be as similar as possible to the CAV (e.g., video angle, length of time and number of actions/verbalizations, background props). Since two scripted storylines were used and an ICV and CAV format available for both, there were a total of four videos in the study. The dependent variables measured included attending to the video and toys, scripted vocalizations, and scripted actions. In order to compare the acquisition of scripted play using ICV or CAV, a multi-element experimental design was used and the format of the videos counterbalanced across participants. After viewing the video (ICV or CAV) twice, the children were allowed to play with the same materials from the video for 5-min. The ICV was more effective in teaching the play chains (actions and verbalizations) than the CAV for two of the participants. The third participant learned the play behaviors equally from both types of videos. Average percentage durations of attending to the videos were similar across both formats for all three participants.

Social Play

Ten studies ($n=26$ children) included play with two or more persons (Charlop et al. 2008; Kleeberger and Mirenda 2010; MacDonald et al. 2009; Maione and Mirenda 2006; Nikopoulos and Keenan 2003, 2004; Ozen et al. 2012; Reagon et al. 2006; Taylor et al. 1999). The average age of participants was 7 years, 5 months (range 4 years, 4 months to 15 years). In addition to functional and pretend play skills, play within a social context (e.g., parallel play, reciprocal play, cooperative play) as well as social skills within play activities (e.g., initiations and responding to others' play bids) were measured. Adults were used exclusively as models in six

studies (Charlop et al. 2008; Kleeberger and Mirenda 2010; MacDonald et al. 2009; Maione and Mirenda 2006; Nikopoulos and Keenan 2007; Ozen et al. 2012), adult and child (mixed models) in three studies (Nikopoulos and Keenan 2003, 2004; Taylor et al. 1999) and only children models in one study (Reagon et al. 2006). Four studies reported video length duration, ranging from 30 s to 4 min (Maione and Mirenda 2006; Nikopoulos and Keenan 2003, 2007; Reagon et al. 2006). Four studies reported number of scripted play behaviors modeled in the video, which ranged from 6 to 21 scripted actions or comments (MacDonald et al. 2009; Ozen et al. 2012; Reagon et al. 2006; Taylor et al. 1999).

Maione and Mirenda (2006) used multiple video models to teach language skills associated with toy play to a 5-year-old boy with autism, Ryan. Three toy sets (e.g., Play Doh™, toy cars, and tree house) were utilized in a multiple baseline across activities design. A total of nine videos were developed, three for each of the toy sets. The videos were approximately 1.5-min long and consisted of two adults playing with the toys and talking to each other using a variety of comments, questions, acknowledgments, initiations, and responses in three- to six-word phrases. During intervention with the first toy set, Ryan watched the three videos associated with the toy. Then a peer without disabilities joined him for a 15-min play session. The children were told, “time to play [activity]” and directed to one of the three sets of play materials. Every 5 min, the children were transitioned to a set of toys. Researchers measured scripted and unscripted verbalizations, initiations towards peers, and responses to peers. Initiations were comments or questions that were not contingent on a peer’s utterance and included requests, compliments, and comments about an object or the ongoing activity. Responses to peers were defined as verbalizations that were contingent on a peer’s immediate utterance including acknowledgements, agreements, comments about the ongoing activity, and questions related to a peer’s comments. Five phases were conducted: baseline, video modeling, video modeling plus feedback (play doh and cars only), video modeling plus feedback and prompting (cars only), and follow up. Feedback consisted of showing the Ryan a video of himself and a peer engaging in the play activities. The researcher then occasionally paused the tape and asked Ryan to evaluate his behavior in the video for “good talking” or “not good talking”. During prompting, verbal and visual prompts were used initially and then faded over time. When only video modeling was used, researchers saw improvement for unscripted and scripted verbalizations and initiations for the tree house toy set only. When video feedback was added, levels of initiations, unscripted, and scripted verbalizations improved; however, the data were still variable for one activity (cars). For this set of toys only, prompting was added leading to increased initiations, unscripted, and scripted vocalizations. Responses to peers verbalizations, however, did not increase for any of the toy sets across any of the phases. Follow-up

several weeks later indicated that improvements across skills and toy sets were maintained.

MacDonald et al. (2009) taught two boys, 5 and 7 years to engage in sequences of reciprocal play with typically developing peers. Play was centered around three play sets (e.g., airport, zoo, and barbeque grill set) consisting of a base structure and several characters and objects. Three videos were made, one for each play set. In the video, two adults, matched for gender of the participant and peer, acted out scripts containing 14 to 17 play actions and accompanying verbalizations. Scripts consisted of manipulating the characters and “speaking” for them such that the characters were interacting or conversing. Four-minute play sessions were conducted in baseline, training and probes. Six variables were measured: scripted play (actions and verbalizations), unscripted play (actions and verbalizations), cooperative play, and reciprocal verbal interaction chains. Scripted and unscripted play was measured throughout the study while cooperative play and reciprocal chain interactions were measured only in baseline and mastery. During baseline, the participant and peer were allowed to play with the toy set for 4 min. During video modeling, the pairs watched the video twice and then were immediately provided with the toy from the videos. No prompts or reinforcement were provided. After the participant met mastery criteria, mastery probes were conducted without the video model. Follow-up probes were conducted 1 month following mastery. Similar results were reported for both participants. Therefore, only one participant’s result will be discussed. Both scripted actions and verbalizations increased with the introduction of video modeling, indicating acquisition of the script. Cooperative play, defined as being within close proximity with another peer and engaging in the same activity, increased from 17, 0.06, and 15 % of intervals during baseline for the airport, zoo and grill to 87, 85 and 90 % respectively. Reciprocal verbal interaction chains, defined as a sequence of two or more verbalizations between the participant and peer, increased from zero sequences in baseline to means of five sequences for the airport toy, six for both the zoo and grill toys during mastery probes. These sequences were not only increased in frequency, but the mean lengths of interaction were 7.5, 10, and 7 s, for the airport, zoo and grill toys. These outcomes were maintained at follow-up probes. Results for unscripted behaviors, however, were mixed as one participant demonstrated increased unscripted play for two of the toy sets while the second participant did not show any improvements.

Discussion

This review identified 22 studies that reported the effects of video modeling on play behaviors for children with ASDs.

The results suggest that video modeling is an effective intervention, corresponding with the positive findings reported in other reviews on video modeling (McCoy and Hermansen 2007; Shukla-Mehta et al. 2010). Of the 22 reviewed studies, use of video modeling was effective for 82 % of participants in increasing scripted play actions and vocalizations. In addition to using video modeling to intervene on play skills, a number of studies also targeted social skills. These studies were categorized as social play and included teaching initiating or responding to bids to play with others, imitation skills and reciprocal play (Charlop et al. 2008; Kleeberger and Mirenda 2010; MacDonald et al. 2009; Maione and Mirenda 2006; Nikopoulos and Keenan 2003, 2004). In two studies, targeting social skills within a play context led to collateral increases in cooperative play (Charlop et al. 2008) and reciprocal play (Nikopoulos and Keenan 2007). A majority of studies targeted either functional or pretend play skills. Functional play included using toys as their intended function (e.g., throwing or bouncing a ball) or in a conventional association of two objects (e.g., putting plastic food on a spoon). Pretend play (also called symbolic play), included using an object as if it were another object (e.g., using a ball as if it were a cannonball), attributing properties to an object which it does not have (e.g., using the spoon as an extension of a robot) or referring to absent objects as if they were present (e.g., make believe food on the spoon; Baron-Cohen 1987). Nearly half of the studies involved sociodramatic play, a more advanced form of pretend play in which the children take on characters or roles and act out real-life experiences, fantasy, and drama scripts. Sociodramatic play was taught in both solitary and social play situations (Boudreau and D'Entremont 2010; D'Ateno et al. 2003; MacDonald et al. 2005, 2009; Maione and Mirenda 2006; Palechka and MacDonald 2010; Ozen et al. 2012; Reagon et al. 2006; Taylor et al. 1999). Given the lack of appropriate play and social skills as diagnostic criteria for ASDs, it is not unusual that they are often targeted in intervention programs for young children with autism. Additionally, play activities were utilized as the medium for teaching social skills, a practice often utilized in programs for early learners.

Similar to previous reviews on video model interventions, the models in the intervention videos were adults rather than children. Adults are often selected out of convenience because they are easy to recruit and direct. Although few studies made efforts to individualize the models in the videos to characteristics of the participants (e.g., gender), most studies resulted in positive outcomes for acquisition of play behaviors. These results support previous research that successful video model interventions have been achieved regardless of whether the model in the video is an adult, peer, or of matched gender to the participants (McCoy and Hermansen 2007). However, little is known about the effects of the model type (e.g., adult, peer, sibling) on generalization of learned skills. A child's

ability to play next to or with other children is an important outcome since play is often the context used to target social skills with other children (e.g., inclusion, free play, recess). Recruitment of siblings and/or peers to serve as the model in a video modeling intervention may be a viable strategy to naturally program for generalization. Of the six studies in which a child played with one of the models in the video intervention, two studies measured generalization with other peers and reported positive results (Nikopoulos and Keenan 2003, 2007). An additional study reported anecdotal positive evidence of generalization with a sibling who was not part of the study (Reagon et al. 2006). Of two studies that used adults as models and reported generalization with other people, the results were mixed for play skills. Charlop et al. (2008) showed two boys with autism video models of two people having conversations with and about toys and measured play as an ancillary variable during free play sessions. Both participants increased parallel and interactive play with another child with autism and a peer, but only one showed positive results with an adult. Kleeberger and Mirenda (2010) reported a low level increase in generalization probes of play with another adult. Given these limited results, further research should explore the effects of the type of model on generalization probes. There are, potentially, other positive effects for involving peers and siblings as the model and play partner. Engaging siblings as part of interventions with children with autism may result in positive changes in familial relationships (Ferraioli et al. 2012). Reagon et al. (2006), for example, reported that after the participant's brother was involved as the model and play partner, the sibling felt that "playing with his brother was fun and he learned how to play with him". Understanding the positive and negative aspects of including similarly aged peers or siblings as models and play partners requires more systematic inquiry.

Additional strategies were employed in combination with video modeling for half of the studies. The most common addition was the use of noncontingent or contingent reinforcement, usually in the form of verbal praise and/or small edible foods (reported in nine studies). Noncontingent reinforcement was mainly used to maintain interest and general participation. Contingent reinforcement was provided to increase imitation of the target behaviors in the video, however it is not known the extent that either reinforcement procedure is required to garner positive outcomes. The second most common additional component included prompting during play (reported in six studies). Verbal or visual prompts were delivered either prior to the occurrence of behavior to encourage correct responding or as part of an error correction procedure (i.e., after the child has made an error, the prompt indicates what the response should be). Prompted behaviors were usually followed by reinforcement. The addition of reinforcement or

prompts to the video modeling intervention increased the effectiveness of the overall intervention. For example, Sancho et al. (2010) compared the effectiveness of traditional video modeling and simultaneous prompting during video modeling to teach scripted play actions and verbalizations to two children with autism. During traditional video modeling, a 2-min video of the experimenter manipulating the toys was shown without any other prompts or further instruction. During simultaneous video modeling, researchers physically prompted and reinforced imitated play actions throughout the showing of the video. Prompts were faded and an error correction procedure was also implemented. Although both formats increased scripted actions, the simultaneous video model format increased scripted verbalizations within fewer sessions. In a few cases, more intensive strategies or modifications such as direct feedback (Maione and Mirenda 2006) or modifying the video into shorter, separate segments (Taylor et al. 1999; Tereshko et al. 2010) were required to produce behavior change. Although the traditional video modeling format may not be fit for all children, but it is encouraging that relatively simple modifications may improve participant outcomes.

There is a scarcity of research on the identification of prerequisite skills participants need to be successful with video model interventions. In previous video modeling literature, researchers have suggested memory, attending, and imitation skills, however support for these as prerequisites for video modeling is mainly through conjecture rather than an empirical analysis (McCoy and Hermansen 2007; Rayner et al. 2009). Five of the studies in the current review reported formal or informal assessments for skills thought to facilitate the success of a VM play intervention (e.g., imitation, attending, communication, play skills) prior to intervention (Hine and Wolery 2006; Lydon et al. 2011; Palechka and MacDonald 2010; Paterson and Arco 2007; Tereshko et al. 2010; however, only one study used the assessments as inclusion criteria for participant selection (Paterson and Arco 2007). This distinction is important because two participants were excluded from continuing the study due to their inability to attend to the video without being distracted. It is unknown whether these individuals would have benefited from a video model intervention or from a different format of instruction. One study linked pretreatment assessment results to the need to adapt the video model intervention to gain successful outcomes (Tereshko et al. 2010). Tereshko et al. (2010) taught four participants to build toy figurines using blocks that stack and connect. When all eight steps of the video model were shown in one sitting, three out of four participants performed poorly. The authors observed that these three students also performed poorly on delayed match-to-sample assessments. After the video was reduced to smaller video segments (one to

two steps) and then chained together upon mastery of each of the smaller segments, these three participants were successful in learning how to put together the toys. The authors noted that the fourth participant, who was successful with the full video model intervention, also reached mastery for delayed match-to-sample skills. These descriptive data highlight the need for research to provide a comprehensive picture of the prerequisite skills needed for individuals to benefit from video model interventions.

One of the indicators of true acquisition of new skills includes maintenance and generalization results (Stokes and Baer 1977). A total of 16 studies reported maintenance data. Improvements from video model interventions appeared to be maintained, at least for the short term. Fourteen studies reported positive results for short-term maintenance data (withdrawal of intervention immediately after mastery up to 3 weeks post intervention). Five studies reported mixed results for long-term maintenance data (1 to 4 months post intervention). It may be necessary to provide booster sessions to help maintain newly learned play skills over a longer period of time. A total of fifteen studies reported generalization data. Five of the six studies that measured generalization of newly acquired play skills across settings and people reported positive results. Generalization across novel toys and materials in eight studies were mixed, however. Studies with positive results indicate there are some strategies that may aid in generalization with new materials. Dupere et al. (2013) examined the use of substitutable video model loops on play behaviors with toy characters that were not shown in the video model training. Substitutable video model loops are sections of the video model script that can be applied to various characters, representing slight variations of the same video model intervention storyline or a version of multiple-exemplar training (Stokes and Baer 1977). Two of three children applied the play behaviors from the video model with the toy characters not shown in the substitutable video model loops. Paterson and Arco (2007) studied how the level of similarities between the toys used in training and novel toys used in generalization probes could affect results with two boys with autism. When novel toys were thematically related to the toys used in the training phase (e.g., all construction themed such as construction bulldozer, dump truck, control booth with boom gate and figurines in hard hats), one child participant demonstrated generalization of verbal and motor play behaviors with the novel toys. Alternatively, when the novel toys were not thematically related (e.g., construction bulldozer, jet ski, helicopter, and male figurines), the second participant did not demonstrate generalization of play behaviors. The authors concluded

that when assessing generalization of play with toys, the types of toys should be carefully selected. Caution is warranted, as the support for these strategies has not yet been replicated.

Several studies highlighted the substantial lack of unscripted play as a concern with video modeling interventions used to teach play skills. Eight studies measured unscripted play behaviors. One study reported positive results (Maione and Mirenda 2006), two reported mixed results (one participant showed improvement while others did not) (MacDonald et al. 2009; Taylor et al. 1999), and five reported little or no improvements for any participants (Boudreau and D'Entremont 2010; D'Ateno et al. 2003; MacDonald et al. 2005; Reagon et al. 2006; Sancho et al. 2010). However, even the improvements for unscripted play behaviors were not without limitations. Sancho et al. (2010) reported unscripted verbalizations but noted they were repetitive or stereotypic in nature. Although Maione and Mirenda (2006) described improvements in unscripted verbalizations, they reported baseline data as total numbers of verbalizations rather than differentiating between scripted and unscripted verbalizations. Therefore, it is unclear whether unscripted verbalizations improved or stayed the same after the introduction of the video model intervention. Given that one of the core characteristics of autism spectrum disorders is a lack of spontaneous play and a penchant for repetitive or routine behaviors, current video model research has not sufficiently addressed this aspect of improving play behavior.

Although current research supports the use of video modeling to teach new play skills to children with ASDs, the application of this technology is still limited. For example, although most of the intervention sessions took place in applied settings (e.g., home and school settings), participants often received the intervention on an individual basis. Given the relative simplicity of video model interventions, future research may explore “scaling up” the administration of video model interventions with small groups of children or as part of the curriculum lesson for pullout type of services common in special education of public schools. Ozen et al. (2012) utilized video model interventions successfully within a small group format, but did not provide additional details of the groups (e.g., number of children, involvement of typically developing peers).

Most of the reviewed studies utilized single subject research designs. However, none of the studies utilized the media equipment during baseline sessions to rule out the effects of introducing technology on play skills. While Palechka and MacDonald (2010) reported that the play skills of three children did not improve by watching a commercially developed cartoon version of the same storyline in the video model, it is essential to reduce threats to internal validity when possible. Future research should therefore use the technology during baseline as well as intervention.

In order to increase the effectiveness of video modeling interventions on play behaviors of children with autism, future research should develop a consistent assessment protocol that includes the identification of prerequisite skills. Few of the reviewed studies included a clear assessment procedure to determine children who were most likely to succeed with a video modeling intervention. Tereshko et al. (2010) assessed a battery of potential prerequisite skills (e.g., motor imitation, attending to the video, actions with objects) yet the only prerequisite skill required to be included in the study was to be able to manipulate the toy blocks without additional help. It is not clear what types of assessments or participant characteristics are necessary for a video model intervention to be suitable for improving play.

Given the lack of improvement in unscripted play behaviors, future research should identify strategies or adaptations to video modeling that encourages unscripted play. Some researchers have hypothesized a potential interaction between repeated viewings of video model or the use of dense reinforcement schedules and decreased unscripted or novel play (Boudreau and D'Entremont 2010). Future research should identify the instructional conditions or modifications that foster the efficacy of video model interventions and novel play. Taylor et al. (1999) observed more unscripted verbalizations using a mastery criterion that allowed for unscripted commenting and forward chaining. For example, to meet mastery criterion, the child was required to give the same number of verbalizations as was shown in the video model, but they could be either scripted or unscripted verbalizations. The forward chain consisted of systematically adding more scripted actions. For example, if the video model consisted of four scripted play verbalizations, upon demonstrating any four appropriate play verbalizations, the child then watched the video model with the same four actions and one to two additional actions. These less stringent criteria may have encouraged increased play behavior for unscripted play while still providing a model for appropriate play. Other behavioral strategies associated with increasing spontaneous responding could be combined with video modeling. For example, script fading is effective in the production of unscripted social interaction skills (Krantz and McClannahan 1998; Wichnick et al. 2010). It seems plausible that a similar use of video modeling in which the video model is faded or cut shorter over time might be explored. Given that reinforcement was commonly used in addition to video modeling, the type of reinforcement schedule should be explored in future research. Although fixed or variable ratio schedules of reinforcement are often used to teach new skills, some research suggests that differentially reinforcing variable or novel responding may lead to behaviors that are not explicitly taught. For example, lag schedules could potentially be used to enhance video model interventions. Lag schedules are a type of differential reinforcement schedule with a multitude of evidence in the

basic arena for increasing variability and novel responding of nonhuman subjects. However, the research involving lag schedules is severely lacking in current applied research. Future studies should replicate and address other strategies to foster unscripted play behavior.

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