The Effect of Video Modeling on Preschoolers' Learning Who are Diagnosed with Autism Spectrum Disorder: A Meta-Analysis

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Abstract

We conducted a meta-analysis of 22 video modeling intervention studies that included 49 preschool children diagnosed with autism spectrum disorders. Using the Nonoverlap of all pairs (*NAP*), an index of data overlap between phases in single-case research, we calculated effect size. Effect sizes for subgroups were also calculated. The subgroups included play, socialization, communication, imitation, and life skills. Finally, we conducted a t- test to compare effect sizes between subgroups. Results showed that overall effect size was 0.85 which was found to be medium and subgroups were all found to have medium effects as well and ranged from 0.73 to 0.92. The *t*- test yielded non-significant results between the five sub-groups. Results across the studies indicated that video modeling is effective in teaching these skills. We discuss the results and make suggestions for future researchers and practitioners.

Keywords: *Autism. Video modeling. Preschool. Play. Socialization. Communication. Imitation. Life skills. Meta-analysis.*

The Effect of Video Modeling on Preschoolers' Learning Who are Diagnosed with Autism Spectrum Disorder: A Meta-Analysis

Autism spectrum disorder (ASD) has been defined as "Persistent deficits in social communication and social interaction across contexts, not accounted for by general developmental delays, and manifest by 3 of 3 symptoms: Deficits in social-emotional reciprocity; ranging from abnormal social approach and failure of normal back and forth conversation through reduced sharing of interests, emotions, and affect and response to total lack of initiation of social interaction. Deficits in nonverbal communicative behaviors used for social interaction; ranging from poorly integrated-verbal and nonverbal communication, through abnormalities in eye contact and body-language, or deficits in understanding and use of nonverbal communication, to total lack of facial expression or gestures. Deficits in developing and maintaining relationships, appropriate to developmental level (beyond those with caregivers); ranging from difficulties adjusting behavior to suit different social contexts through difficulties in sharing imaginative play and in making friends to an apparent absence of interest in people. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least 2 of 4 symptoms: Stereotyped or repetitive speech, motor movements, or use of objects; (such as simple motor stereotypies, echolalia, repetitive use of objects, or idiosyncratic phrases). Excessive adherence to routines, ritualized patterns of verbal or nonverbal behavior, or excessive resistance to change; (such as motoric rituals, insistence on same route or food, repetitive questioning, or extreme distress at small changes). Highly restricted, fixated interests that are

abnormal in intensity or focus; (such as strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests). Hyper-or hypo-reactivity to sensory input or unusual interest in sensory aspects of environment; (such as apparent indifference to pain/heat/cold, adverse response to specific sounds or textures, excessive smelling or touching of objects, fascination with lights or spinning objects). Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities. Symptoms together limit and impair everyday functioning." American Psychiatric Association (2013). Signs of ASD begin during early childhood and typically last throughout a person's life (CDC, 2014).

Based on the CDC's recent surveillance report (2014), 1 in 68 children is diagnosed with autism in the USA. Due to the increasing number of children diagnosed with ASD, much research has been devoted to develop early intervention strategies targeting the essential deficits in children with autism (Litras, Moore & Anderson, 2010) including socialization, communication, imitation, life skills, and play skills using different interventions. They include, peer mediated interventions (Bene, Banda, and Brown, 2014; Dugan, Kamps, and Leonard, 1995; Kamps, Barbetta, Leonard, & Delquadri, 1994; Maione and Mirenda, 2006; Sperry, Neitzel, and Engelhardt-Wells, 2010), PRT (Pierce and Schreibman, 1995; Stahmer, 1995), self-management strategies (Callahan, and Rademacher, 1999; Koegel, Koegel, Hurley, and Frea, 1992; Lee, Simpson, and Shogren, 2007; Stahmer, and Schreibman, 1992), and video modeling (Boudreau & D'Entremont, 2010; D'Ateno, Mangiapanello & Taylor, 2003; Hine & Wolery, 2006; ; Kleeberger and Mirenda, 2008; MacDonald, Clark, Garrigan & Vangala, 2005; MacDonald, Sacromone, Mansfield, Wiltz & Ahearn, 2009; Tereshko, MacDonald & Ahearn, 2009; Maione & Mirenda, 2006).

In recent years however, technology, particularly video modeling (VM) has emerged as an effective instructional technique to teach various skills to children with ASD. VM has been reported as an evidenced-based practice by the National Autism Center (NAC, 2009). It is an instructional technique which focuses on learning through observation and imitation of others, that typically involves presenting a videotaped sample of a model engaging in a series of scripted actions and/or verbalizations. The target student then demonstrates the observed behavior. Video modeling can include any number of components but generally involve the following: (a) edited images of appropriate or new behavior shown on a monitor to a child, (b) repeated clips of the behavior shown to the participant, (c) discrete practice sessions or role-playing of the new skills, (d) assessment of skills generalization (e.g. probes across settings, people or materials) and (e) periodic review of tapes, if needed (Hine & Wolery, 2006).

According to the National Professional Development Center on Autism Spectrum Disorders (2011), video modeling is an evidenced-based intervention for individuals with ASD in elementary through middle school. The models that have been used in the videos include peers (Maione & Mirenda, 2006), adults (Rehfeldt et al., 2003), parents and siblings (Taylor, Levin, & Jasper, 1999). Several studies have found that ASD can be reliably diagnosed in children less than 3 years of age by experienced, highly trained clinicians in specialty clinic and research settings (Charman et al., 2005; Lord et al., 2006; Turner & Stone, 2007). Children at a young age learn a vast array of skills by observing others (Bellini & Akullian, 2007); hence video modeling serves the purpose of directing the child's attention to a given task by observing it.

Video modeling is based on social learning theory (Bandura, 1977). In his social learning theory, Bandura highlighted the fact that most behavior is learned through modeling or observing another person performing a given behavior. Hence, observational learning through video modeling can help children diagnosed with ASD to learn direct instruction of skills and behaviors. In video modeling for example, the child copies behavior from watching recorded behaviors displayed by his peers or other people. Elements that motivate his peers or other people also motivate the child. Video modeling is based mainly on observation of a behavior and its associated reinforcing elements. Bellini, Akullian, and Hopf (2007) defined video modeling as an intervention method that is often utilized for social skills training involving participants who watch a video of someone who models a preferred behavior. The participants then imitate the behavior showed in the video.

There have been few reviews on video modeling on children with autism (Acar & Diken, 2012; Delano, 2007). Bellinini and Akullian (2007) focused their meta-analysis study on participants ranging from 3 through 11 years of age. They reviewed 31 peer-reviewed articles on VM with children with autism. Results of studies have indicated that video modeling is effective on teaching social skills, play skills, language and communication skills, functional skills, self-care skills, and daily life skills to children with autism. The studies have been categorized based on their scopes: studies conducted using only video modeling, video modeling studies in which subjects of studies are models, studies in which video modeling and additional practices are used together and studies in which video modeling is compared with other practices.

Delano (2007) conducted a review of 19 VM studies with individuals with autism. The findings suggest that video modeling interventions are effective in teaching a variety of skills to children with autism. There are some reviews on children focusing on specific skills with video modeling as one of the interventions. For example, in terms of play skills, Jung and Sainato (2013) and Lang, O'Reilly, Rispoli et al. (2009) reported 5 studies using video modeling in children of the age group 3-9 and 0-8 respectively. Gillis and Butler's review (2007) on social skills intervention for preschoolers (2-5 years old) reported 4 studies using video modeling intervention. However, these reviews did not address skills in communication, imitation and living skills. Also, these reviews used PND (Percentage of non-overlapping data) and not NAP (Nonoverlap of all pairs). In addition, the previous meta-analysis study addressed social-communication, functional and daily living skills as well as play skills but the targeted age group was three through twenty-year-old (Bellini & Akullian, 2007). Although the above reviews (Jung & Sainato, 2013; Gillis & Butler, 2007; Lang et al., 2009) targeted the age groups of 0-9 years old, they did not specifically look at pre-school age groups and they also reported only a few studies using video modeling as an evidence-based practice.

Stahmer, Ingrsoll, & Carter (2003) found that VM may be beneficial for children who initially avoid interactions, who present with limited reinforcers to use in more traditional behavioral teaching techniques. The advantage is that models can be watched several times and watching videos can be a natural reinforcement which motivates these individuals (Charlop-Christy, Le, & Freeman, 2000; Corbett, 2003; Corbett & Abdullah, 2005). Therefore, this increases the predictability and controllability of the model, which makes learning easier for children with autism as it allows extraneous features to be filtered out (Hine & Wolery, 2006).

The purpose of this meta-analytic study was to analyze the effectiveness of video modeling by focusing on communication, imitation, and living skills including play and socialization in the preschool age group. This review also included studies conducted from 2003 through 2014 to obtain more recent findings. This may help to inform practitioners and researchers by extending the knowledge level on the effectiveness of video modeling on preschoolers with autism spectrum disorder.

Method

We searched EBSCO databases, which included PsychInfo, ERIC, Social Sciences Index, and Psychological Abstracts using the following terms: *video modeling, video modeling and preschoolers, autism and video modeling and ASD and modeling, teaching communication, social, and academic development to children diagnosed with autism*, *ASD, improving social skills and disruptive behavior in children with autism.* We selected studies that met the following criteria. (a) Researchers conducted studies with children with autism spectrum disorder between 3 to 5 years of age using VM (b) studies used single-subject designs (c) investigators used children between the age group of 3 through 5 years. (e) studies were published in peer-reviewed journals between 2003-2016.We conducted an ancestral search for additional studies under the reference section of each selected study and found none. Overall, we selected 22 studies that met the inclusion criteria.

A graduate student and special education faculty member examined 30 % of the selected studies to determine fidelity to the inclusion criteria and found 100 % agreement regarding the identification and presence of the inclusion criteria. We analyzed the selected studies across several variables including demographics, target skills, designs, results [effect sizes using nonoverlap of all pairs (NAP)], maintenance, generalization, and social validity.

NAP is an index of data overlap between conditions in single-subject design research. Its main hypothetical advantage is that it is an inclusive test of all possible sources of data overlap. NAP is a probability score, generally ranging from 0.5 to 1. It has been described as a strong methodology (Parker and Vannest 2009). It discriminates better among results from a large group of published studies and produces less human errors in calculations than the other three hand-calculated indices i.e., PND: percentage of non-overlapping data points, PAND: percent of all non-overlapping data, and PEM: percentage of data exceeding the median (Parker & Vannest 2009).

When using NAP, the researchers measured all baselines against all treatment data points. First, the researchers multiplied the total number of data points in the baseline phase by the total number of data points in the treatment phase. Next the researchers measured each point in the baseline against each treatment data point that overlap. For each point in the baseline phase that is higher than each treatment point, the analysis yielded 1 point and for points that are on the same line, the analysis yields 0.5 point. Finally, the researchers computed total score by summing up all yielded points, which they divided by the result of the division in the first phase. Parker and Vannest (2009) proposed tentative NAP ranges: 0–0.65 = weak effects, 0.66–0.92 = medium effects and 0.93–1.0 l = large or strong effects. Transforming NAP to a zero-chance level gives these corresponding ranges: weak effects, 0–0.31; medium effects, 0.32–0.84; and large or strong effects, 0.85–1.0

Results

Participants

The 22 studies reviewed included 49 participants of the age group 2 – 5 years 11 months, with an average age of 3 years 8 months. Most the participants were diagnosed with autism (n=47), some with developmental delay (n=7) and only 1 with Asperger syndrome.

Settings

The most common settings that researchers have conducted their studies were homes (Cardon, 2012; Gena, Coloura & Kymissis, 2005; Kleeberger and Mirenda, 2008; Litras, Moore & Anderson, 2010; Maione & Mirenda, 2006; Sherer, Pierce & Paredes 2001; Shrestha, Anderson & Moore, 2013), classrooms (Apple, Billingsley & Shwartz, 2005; Cihak, Smith, Cornett & Coleman, 2012; MacDonald, Clark, Garrigan & Vangala, 2005; Plavnick, 2012; Plavnick & Ferrari, 2011; Tereshko, Wert & Neisworth, 2003; Wilson, 2013) and university clinics (Hine & Wolery, 2006; MacDonald, Sacromone, Mansfield, Wiltz & Ahearn, 2009; Shipley-Benamox, Lutzker & Taubman, 2002;) respectively. Three studies were also carried out in a treatment or intervention centers (Boudreau & D'Entremont, 2010; D'Ateno, Mangiapanello & Taylor, 2003; Scheflen, Freeman & Paparella, 2012) and one in a school playground (Buggey, 2012)**.**

Trainers

Eight studies reported researchers as trainers (Apple, Billingsley & Shwartz, 2005; Cardon, 2012; Hine & Wolery, 2006; Litras, Moore & Anderson, 2010; MacDonald, Sacromone, Mansfield, Wiltz & Ahearn, 2009; Maione & Mirenda, 2006; Wert & Neisworth, 2003; Wilson, 2013). Three studies have therapists as trainers (Gena, Coloura & Kymissis, 2005; Kleeberger &Mirenda, 2008; Sherer, Pierce & Paredes 2001;). Another three studies have researchers themselves creating the videos (Buggey, 2012; Scheflen, Freeman & Paparella, 2012; Shipley-Benamox, Lutzker & Taubman, 2002). However, eight studies did not report any trainer (Boudreau & D'Entremont, 2010; Cihak, Smith, Cornett & Coleman, 2012; D'Ateno, Mangiapanello & Taylor, 2003; MacDonald, Clark, Garrigan & Vangala, 2005; Plavnick, 2012; Plavnick & Ferrari, 2011; Shrestha, Anderson & Moore, 2013; Tereshko, MacDonald & Ahearn, 2009).

Targeted Skills

One half of studies (n=11) targeted communication skills of preschoolers (Apple, Billingsley & Shwartz, 2005; Buggey, 2012; Cihak, Smith, Cornett & Coleman, 2012; Gena, Coloura & Kymissis, 2005; Litras, Moore & Anderson, 2010; Maione & Mirenda, 2006; Plavnick & Ferrari, 2011; Scheflen, Freeman & Paparella, 2012; Wilson, 2013 Sherer, Pierce & Paredes 2001; Wert & Neisworth, 2003). Four studies focused on improving attention and imitating skills (Cardon, 2012; Plavnick, 2012; Kleeberger and Mirenda, 2008; Tereshko, MacDonald & Ahearn, 2009;) and five studies on play actions (Boudreau & D'Entremont, 2010; D'Ateno, Mangiapanello & Taylor, 2003; Hine & Wolery, 2006; MacDonald, Clark, Garrigan & Vangala, 2005; MacDonald, Sacromone, Mansfield, Wiltz & Ahearn, 2009).

Video Models

In most of the studies (n=8), adults were used as models in the video clips (Boudreau & D'Entremont, 2010; D'Ateno, Mangiapanello & Taylor, 2003; Hine & Wolery, 2006; Kleeberger and Mirenda, 2008; MacDonald, Clark, Garrigan & Vangala, 2005; MacDonald, Sacromone, Mansfield, Wiltz &

Ahearn, 2009; Maione & Mirenda, 2006; Tereshko, MacDonald & Ahearn, 2009). Peers were also used as models in four studies (; Cihak, Smith, Cornett & Coleman, 2012; Gena, Coloura & Kymissis, 2005; Plavnick, 2012; Plavnick & Ferrari, 2011).

Only two studies have used self-video models (Buggey, 2012; Wert & Neisworth, 2003) and in two studies researchers were models (Scheflen, Freeman & Paparella, 2012; Shipley-Benamox, Lutzker & Taubman, 2002). Teachers (Wilson, 2013), a parent (Shrestha, Anderson & Moore, 2013), and a caregiver and siblings (Cardon, 2012) were also used as models in the studies. Only six (Boudreau & D'Entremont, 2010; Cardon, 2012; Cihak, Smith, Cornett & Coleman, 2012; Shrestha, Anderson & Moore, 2013; Wilson, 2013; Wert & Neisworth, 2003) out of the 22 studies reported the length of video clips with a means of 6 minutes per video clip and a range from1.15 to 13.13.

Mode of Presentation

All studies have selected different modes of video presentation. Researchers in seven studies selected the television as a mode of presentation (D'Ateno, Mangiapanello & Taylor, 2003; Gena, Coloura & Kymissis, 2005; MacDonald, Clark, Garrigan & Vangala, 2005; MacDonald, Sacromone, Mansfield, Wiltz & Ahearn, 2009; Maione & Mirenda, 2006; Shipley-Benamox, Lutzker & Taubman, 2002; Wert & Neisworth, 2003), followed by three studies using video cameras (Buggey, 2012; Cihak, Smith, Cornett & Coleman, 2012; Sherer, Pierce & Paredes 2001). Some studies used computer screens (Litras, Moore & Anderson, 2010; Scheflen, Freeman & Paparella, 2012; Shrestha, Anderson & Moore, 2013), laptops (Boudreau & D'Entremont, 2010; Hine & Wolery, 2006), iPhones (Plavnick, 2012; Plavnick & Ferrari, 2011;), DVD played on DVD players (Kleeberger and Mirenda, 2008; Tereshko, MacDonald & Ahearn, 2009), iPad (Cardon, 2012), and movie (Apple, Billingsley & Shwartz, 2005) as a mode of presentation. However, one study (Wilson, 2013) did not mention the mode of presentation.

Effectiveness of the strategy based on the Effect size (NAP)

The overall Effect size for all 22 studies is 0.85 with a 95% C. I. [0.80, 0.89]. We split the data into five sub-groups – play, communication, imitation, socialization, and living skills. The effect size for play is 0.87, communication is 0.85, imitation is 0.92, socialization is 0.73 and life skills are 0.9. A *t*- test yielded non-significant results between the five sub-groups. Thus, we can say that video modeling was evidenced as strongly effective in teaching the five different target behaviors to the pre-school age group.

Parker and Vannest (2009) proposed tentative NAP ranges: 0–0.65=weak effects, 0.66–0.92=medium effects, and 0.93– 1.0 l=large or strong effects. Transforming NAP to a zero chance level gives these corresponding ranges: weak effects, 0–0.31; medium effects, 0.32–0.84; and large or strong effects, 0.85–1.0. Thus, we interpreted the overall effect size of 0.85 as being a strong effect for video modeling. Tables 1 and 2 provide a detailed summary of studies with effect sizes.

Designs

Majority of the studies (n=11) used a multiple baseline across behavior, participants or activities design (Apple, Billingsley & Shwartz, 2005; Boudreau & D'Entremont, 2010; Buggey, 2012; Cardon, 2012; D'Ateno, Mangiapanello & Taylor, 2003; Gena, Coloura & Kymissis, 2005; Kleeberger and Mirenda, 2008; Litras, Moore & Anderson, 2010; Maione & Mirenda, 2006;

Scheflen, Freeman & Paparella, 2012; Wert & Neisworth, 2003). Five studies used a multiple probe design (Hine & Wolery, 2006; MacDonald, Clark, Garrigan & Vangala, 2005; MacDonald, Sacromone, Mansfield, Wiltz & Ahearn, 2009; Shipley-Benamox, Lutzker & Taubman, 2002; Tereshko, MacDonald & Ahearn, 2009) and two studies used an alternative treatment design (Cihak, Smith, Cornett & Coleman, 2012 Cihak, Smith, Cornett & Coleman, 2012; Wilson, 2013). In addition to these designs, two studies used a changing criterion design (Plavnick, 2012; Shrestha, Anderson & Moore, 2013). However, some studies (n=2) used a combination of both alternative treatment design and multiple baseline/probe design (Plavnick & Ferrari, 2011; Sherer, Pierce & Paredes 2001)**.**

Video Modeling combined with Other Strategies

Some studies have effectively combined video modeling and other strategies such as forward chaining, Picture Exchange communication System (PECS), self-management and video feedback to enhance the behaviors of the participants. Shrestha, Anderson and Moore (2013) reported that a combination of point-of-view modeling and forward chaining was effective in teaching the child with autism functional help skills such as serving himself a snack without any prompting. Cihak, Smith, Cornett & Coleman's study (2012) has shown that using video modeling as a priming technique in conjunction with PECS has increased communicative interactions in preschoolers with limited to no verbal communication skills. The addition of self-management to video modeling helped in producing and maintaining social initiations as seen in Apple, Billingsley and Shwartz's study (2005). In Maione and Mirenda's study (2006), video modeling was effective in increasing social language in 2 out of 3 activities. In the third activity, video feedback plus prompting were done in addition to video modeling to achieve a significant change of target behavior. Participants using PECS+VM to request items that have not previously been acquired during PECS-only intervention.

Comparison across studies

Four studies have done a comparative study of video modeling and other interventions. For example, Wilson (2013) has reported a heterogeneous treatment response of participants to video and in vivo modeling. In the Wilson's study (2013), of the three participants who responded to one or both treatments, outcomes favored video modeling in the first case and in vivo modeling in the second, while treatments were equally effective in the third case. This study shows that some students with ASD may learn more efficiently through in vivo modeling or a combination of modeling modalities. However, greater attention to video model was seen with a margin of 3-48 % attention across sessions and participants. Effect size for in vivo was 0.57; effect size for video modeling was 0.65. On the other hand, a study done by Gena, Coloura and Kymissis (2005), has shown that both video modeling and in vivo modeling increased the affective categories of all 3 participants in the study with effect size of 0.8 for in vivo and 0.9 for video modeling. This difference in findings between the two studies may be due to the fact that the participant in the former study had complex medical diagnoses that may attribute to her lack of response to modeling intervention. Moreover, the latter make use of reinforcement and prompting procedures in both in vivo and video modeling which was not reported in the former study. Another study (Maione & Mirenda, 2006) reported that a combination of video modeling and video feedback is more effective than video modeling alone with effect size of 0.96 and 0.82 respectively.

Sherer et al. (2001) compared the efficacy of 'self' versus 'other' video modeling interventions to enhance the conversation skills in children with autism. The result showed that there was no overall

difference in rate of task acquisition between self-modeling (effect size of 0.73) and other video modeled conditions (effect size of 0.80) and children learn equally well via both treatment approaches.

Maintenance and Generalization

Fifteen studies reported maintenance of skills by participants in their studies (Boudreau & D' Entremont, 2010; Cardon, 2012; Gena, Couloura & Kymissis, 2005;Hine & Wolery, 2006;); Litras, Moore & Anderson, 2010; MacDonald, Clark, Garrigan & Vangala, 2005; MacDonald, Sacramone, Mansfield, Wiltz & Ahearn, 2009; Maione & Mirenda, 2006; Plavnick & Ferreri, 201; Scheflen, Freeman & Paparella, 2012; Sherer, Pierce & Paredes, 2001; Shipley-Benamox, Lutzker & Taubman, 2002; Shrestha, Anderson & Moore, 2013; Wert & Neisworth, 2003; Wilson, 2013). However, maintenance of skills ranged from marginal (Wilson, 2013) to high levels (Boudreau & D'Entremont, 2010). Some studies also reported maintenance of skills at follow up sessions but there was no generalization to objects/settings (MacDonald, Sacromone, Mansfield, Wiltz & Ahearn, 2009; Maione & Mirenda, 2006; Wilson, 2013).

Similarly, fifteen studies assessed generalization of targeted skills (Apple, Billingsley & Schwartz, 2005; Boudreau & D' Entremont, 2010; Cardon, 2012; Gena, Couloura & Kymissis, 2005; Hine & Wolery, 2006; Kleeberger & Mirenda, 2008; Litras, Moore & Anderson, 2010; Plavnick, 2012; Plavnick & Ferreri, 2011; Scheflen, Freeman & Paparella, 2012; Sherer, Pierce & Paredes, 2001; Shipley-Benamox, Lutzker & Taubman, 2002; Shrestha, Anderson & Moore, 2013; Tereshko, MacDonald and Ahearn, 2009; Wert & Neisworth, 2003). Other studies reported actions generalized to settings but maintenance of skills were not reported (Kleeberger and Mirenda, 2008; Tereshko, MacDonald & Ahearn, 2009). In one study (Shrestha, Anderson & Moore, 2013), generalization was limited although the participant maintained his skills during follow up.

Social Validity

Social validity was assessed in eight out of 22 studies (Apple, Billingsley & Shwartz, 2005; Boudreau & D'Entremont, 2010; Buggey, 2012; Cihak, Smith, Cornett & Coleman, 2012; Litras, Moore & Anderson, 2010; Plavnick & Ferrari, 2011; Scheflen, Freeman & Paparella, 2012; Shrestha, Anderson & Moore, 2013). Researchers involved adults, caregivers, parents, teachers, and therapists to assess the social validity of their studies through questionnaires, informal interviews, parents' satisfaction forms and reports. The purpose of social validity was to determine whether interventions were socially relevant, that is whether the results were appropriate, significant or important. Overall, teachers, paraprofessionals, adults, graduate students reported children having significantly better skills in communication, socialization, play skills, imitation and living skills. Parents also reported satisfaction both with the procedures and with the outcomes of the intervention. Some studies found that the investigation procedures were acceptable and video modeling was both time and cost effective (Scheflen, Freeman & Paparella, 2012) and the procedure was appropriate, perceived as fair and ethical (Shrestha, Anderson & Moore, 2013). Parents reported that they perceived acceleration in their child's communicative progress and in overall social functioning and general behavior across the intervention (Litras, Moore & Anderson, 2010). Parent and teacher reports showed that the children frequently responded properly with compliments when presented with initiations from others outside observation periods (Apple, Billingsley & Shwartz, 2005). In Plavnick and Ferreri (2011) caregivers rated both intervention conditions higher than baseline on all items. In Cihak et al.

(2012) all instructors believed that the effect of VM before PECS was positive for all children. They reported that they will continue to use VM as an intervention method for a wide variety of skills. In Buggey (2012), the therapists and parents were keen about making their personal videos. Two teachers reported positive changes in behaviors following the children viewing the videos. Boudreau & D'Entremont, (2010) did not provide details about social validity in their study.

Discussion

The purpose of this study was to analyze the effectiveness of video modeling on five sub-groups – play, communication, imitation socialization and living skills of preschool age group. Based on the results of this study, it can be concluded that video modeling is effective on teaching the different target behaviors to the pre-school age group. Sixty-eight percent of the studies reported maintenance of skills by the participants and another 68% on generalization of learned skills. Moreover, in comparison between video modeling and other interventions (e.g., in vivo modeling), it was reported that greater attention to video model was seen across sessions and participants. Furthermore, video modeling was effectively combined with other strategies such as forward chaining, Picture Exchange communication System (PECS), self-management and video feedback to enhance the behaviors of the participants (Apple et al., 2005; Cihak et al., 2012; Maione & Mirenda, 2006; Shrestha, Anderson & Moore, 2013).

These findings are not different from past meta-analysis. For example, in their study, Bellini, & Akullian (2007) found similar results. For example, Intervention effects for video modeling and video self-modeling (VSM) were both found to be moderate (81% and 77%). Maintenance effects for video modeling and VSM were also both moderate (88% and 71%). Generalization effects were moderate for video modeling (82%). NAP for the current study was .85 with a 95% C. I. [.80, .89] indicating that both studies yielded similar results.

They used 23 single-subject design studies and assessed interventions, maintenance, and generalization effects by computing the percentage of non-overlapping data points (PND). They found that video modeling and VSM are effective intervention strategies for addressing social-communication skills, functional skills, and behavioral functioning in children and adolescents with ASD suggesting that procedures promote skill acquisition and that skills acquired via video modeling and VSM are maintained over time and transferred across persons and settings.

In Bellini & Akullian's study (2007), twenty-three single-subject design studies were included in the meta-analysis. Participants' age ranged from 3-20 years old but it was mostly focused on elementary school-aged children. The number of intervention sessions in each study ranged from 4 to 33 (median = 9.5). The duration of the video clips used during the intervention sessions ranged from 30 seconds to 13 minutes and 30 seconds. This meta-analysis looked at social communication skills and found out that the effect size was 0.77. Intervention, maintenance, and generalization effects were measured by computing the percentage of non-overlapping data points (PND). The study suggested that video modeling and video self-modeling are effective intervention strategies for addressing skills like social-communication, functional and behavioral functioning in children and adolescents with ASD. Moreover, the study also found that these

procedures promote skill acquisition and that skills acquired via video modeling and VSM are maintained over time and transferred across persons and settings.

In another meta-analysis that examined the use of video modeling (VM)–based interventions to reduce the disruptive behaviors of students diagnosed with emotional or behavioral disorders, overall effects were found to be large for reducing challenging behaviors (Losinski, Wiseman, White, & Balluch, 2015).

On the other hand, in the present meta-analysis, twenty-two single subject designs using video modeling as an intervention were included. The age range of the participants in the study is three to five years old. The present meta-analysis also looked at social and communication skills besides other skills and found out that the effect size was 0.73 and 0.85. Interventions were measured by computing the percentage of non-overlap of all pairs (NAP). Generalization and maintenance effects were not measured. The study suggested that video modeling is an effective intervention strategy for addressing skills like play, socialization, imitation, communication and life skills in pre-school children with ASD.

We hypothesize that video modeling is an effective method to teach children with ASD because children like the technology it uses. For example, video modeling utilizes images of appropriate or new behavior shown on a monitor to a child. Repeated clips of the behavior shown to the participant makes it easy for children to learn the targeted behavior. Also the discrete practice sessions or role-playing of the new skills is an asset. Video modeling involves the child viewing videos of a model demonstrating a target skill. Social cognitive theory asserts the more the model and the observer look alike, the better the effect of the model on the learner.

Wolfe (1978) noted that it is critical for the intervention used to result in socially important changes. However, this review showed that there is a lack of studies reporting on social validity (only 50%). Additionally, the length of the videos used was reported in only 4 out of 22 studies. In the present study, the researchers did not find any significant difference between shorter length video and longer ones. For example, in Buggey (2012), the participants viewed videos for 15 minutes daily and resulted in none of the participants making gains in their frequency of social initiations, whereas in Wert & Neisworth (2003), viewing of videos within 60 minutes of school attendance resulted in participants showing significant improvements in requesting. In Cihak, Smith, Cornett & Coleman (2012), a shorter length video of 20-30 seconds showed that all participants learned to use PECS and increased the number of independent communicative initiations.

It was also seen from the review that only 4 studies have done a comparison between video modeling and other interventions, Hence, there is a need for more comparative studies to compare the efficacy of video modeling and other behavioral interventions.

The present study contributes to the existing knowledge based in that, it summarizes past individual studies including meta-analysis studies. Furthermore, it corroborates past findings of video modeling as evidence based practice. Based on the effect size in this study we can infer that video modeling as an early intervention in pre-school children is effective and it is also crucial in order to remediate as early as possible their behavior and skills development. Thus,

video modeling might be one of the approaches that work well with young children diagnosed with ASD.

Limitations

Even though the review concluded the positive effects of video modeling on play, communication, imitation, socialization and life skills of preschool children with autism and developmental disabilities, the findings need to be considered in the view of some limitations. First, we did not include dissertations or unpublished studies, studies available in other languages or/ and unpublished dissertations. Second, some studies did not provide a clear graphic analysis of the results limiting the calculation of effect sizes for some variables. Thirdly, the results of the studies are based on limited number of studies with participants' ages between 3 to 5 years old.

Implications

Scheflen et al. (2012) emphasize the need of proper written instructions to be given to parents and caregivers of children with autism if video modeling is to be effectively implemented. Some other suggestions for practitioners that emerged from the review are the following: (i) providing training in simple editing programs (e.g., Microsoft Movie Maker, Avid FreeDV and Pinnacle VideoSpin) for parents/caregivers and teachers so that they can use such procedures to teach new skills to preschool children with autism and help them increase their independence. (ii) If a child with autism does not initially demonstrate the ability to attend to videos, explicit training in video attending should be used prior to implementing video modeling. (iii) Breaking down video models into video segments to allow children to acquire the skills by requiring shorter period to attend.

Conclusion

This review shows that video modeling may be a viable intervention for teaching different type of skills to preschool children. It facilitated maintenance and generalization of learned skills in several of the participants. However, it should be noted that one of the important tasks of a researcher is to determine what type of children with autism may benefit most from video modeling interventions. Future research in evaluating pre-requisite skills for video modeling is warranted. As seen from this review, video modeling may be an effective technique to use in conjunction with other interventions. But it is necessary to evaluate the effectiveness of this intervention with other age groups, disability categories, and cultural backgrounds as well.

References

Acar, C., & Diken, I. H. (2012). Reviewing instructional studies conducted using video modeling to children with autism. *Educational Sciences: Theory and Practice*, *12*(4), 2731-2735.

Adams, L., Gouvousis, A., VanLue, M., & Waldron, C. (2004). Social story intervention in improving communication skills in a child with an autism spectrum disorder. *Focus on Autism and other developmental Disabilities*, *19*(2), 87-94.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders. 5th ed*. Arlington, VA: American Psychiatric Association.

Apple, A. L., Billingsley, F., Schwartz, I. S., & Carr, E. G. (2005). Effects of video modeling alone and with self-management on compliment-giving behaviors of children with high-functioning ASD. *Journal of Positive Behavior Interventions*, *7*(1), 33-46.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, *84*(2), 191-215.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual review of psychology*, *52*(1), 1-26.

Bellini, S., Akullian, J., & Hopf, A. (2007). Increasing social engagement in young children with autism spectrum disorders using video self-modeling. *School Psychology Review*, *36*(1), 80-90.

Bellini, S., & Akullian, J. (2007). A meta-analysis of video modeling and video self-modeling interventions for children and adolescents with autism spectrum disorders. *Exceptional children*, *73*(3), 264-287.

Bene, K., Banda, D. R., & Brown, D. (2014). A meta-analysis of peer-mediated Instructional arrangements and Autism. *Review Journal of Autism and Developmental Disorders*, *1*(2), 135-142.

Boudreau, E., & D'Entremont, B. (2010). Improving the pretend play skills of preschoolers with autism spectrum disorders: The effects of video modeling. *Journal of Developmental and Physical Disabilities*, *22*(4), 415-431.

Buggey, T. (2012). Effectiveness of video self-modeling to promote social initiations by 3-year-olds with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, *27*(2), 102-110.

Callahan, K., & Rademacher, J. A. (1999). Using self-management strategies to increase the on task behavior of a student with autism. *Journal of Positive Behavior Interventions*, *1*(2), 117-122.

Cardon, T. A. (2012). Teaching caregivers to implement video modeling imitation training via iPad for their children with autism. *Research in Autism Spectrum Disorders*, *6*(4), 1389-1400.

Charlop-Christy, M. H., Le, L., & Freeman, K. A. (2000). A comparison of video modeling with in vivo modeling for teaching children with autism. *Journal of Autism and Developmental Disorders, 30*(6), 537-552.

Charman, T., Taylor, E., Drew, A., Cockerill, H., Brown, J., & Baird, G. (2005). Outcome at 7 years of children diagnosed with autism at age 2: Predictive validity of assessments conducted at 2 and 3 years of age and pattern of symptom change over time. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *46*(5), 500–513. doi:10.1111/j.1469-7610.2004.00377.x.

Cihak, D. F., Smith, C. C., Cornett, A., & Coleman, M. B. (2012). The use of video modeling with the picture exchange communication system to increase independent communicative initiations in preschoolers with autism and developmental delays. *Focus on Autism and Other Developmental Disabilities*,*27*(1), 3-11.

Corbett, B. A., & Abdullah, M. (2005). Video modeling: Why does it work for children with autism? *Journal of Early and Intensive Behavior Intervention*, *2*(1), 2-8.

D'Ateno, P., Mangiapanello, K., & Taylor, B. A. (2003). Using video modeling to teach complex play sequences to a preschooler with autism. *Journal of Positive Behavior Interventions*, *5*(1), 5-11.

Delano, M., & Snell, M. E. (2006). The effects of social stories on the social engagement of children with autism. *Journal of Positive Behavior Interventions*, *8*(1), 29-42.

Delano, M. E. (2007). Use of strategy instruction to improve the story writing skills of a student with Asperger syndrome. *Focus on Autism and Other Developmental Disabilities*, *22*(4), 252-258.

Dugan, E., Kamps, D., & Leonard, B. (1995). Effects of cooperative learning groups during social studies for students with autism and fourth-grade peers. *Journal of applied behavior analysis*, *28*(2), 175.

Gena, A., Couloura, S., & Kymissis, E. (2005). Modifying the affective behavior of preschoolers with autism using in-vivo or video modeling and reinforcement contingencies. *Journal of Autism and Developmental Disorders*, *35*, 545–556.

Gray, C. A., & Garand, J. D. (1993). Social stories: Improving responses of students with autism with accurate social information. *Focus on Autistic Behavior*, *8*(1), 1–10.

Gray C A. (1998). Social stories and comic strip conversations with students with Asperge Syndrome and high-functioning Autism. In: Schopler E, ed. *Asperger syndrome or high functioning autism?* New York: Plenum Press, 167-194.

Grusec, J. E. (1992). Social learning theory and developmental psychology: The legacies of Robert Sears and Albert Bandura. *Developmental Psychology*, *28*(5), 776- 786.

Hine, J. F., & Wolery, M. (2006). Using point-of-view video modeling to teach play to preschoolers with autism. *Topics in Early Childhood Special Education*, *26*(2), 83-93.

Jung, S., & Sainato, D. M. (2013). Teaching play skills to young children with autism. *Journal of Intellectual and Developmental Disability*, *38*(1), 74-90.

Kamps, D. M., Barbetta, P. M., Leonard, B. R., & Delquadri, J. (1994). Classwide peer tutoring: An integration strategy to improve reading skills and promote peer interactions among students with autism and general education peers. *Journal of Applied Behavior Analysis*, *27*(1), 49-61.

Kleeberger, V., & Mirenda, P. (2008). Teaching generalized imitation skills to a preschooler with autism using video modeling. *Journal of Positive Behavior Interventions*.

Koegel, L. K., Koegel, R. L., Hurley, C., & Frea, W. D. (1992). Improving social skills and disruptive behavior in children with autism through self-management. *Journal of Applied Behavior Analysis*, *25*(2), 341-353.

Koegel, R. L., O'Dell, M. C., & Koegel, L. K. (1987). A natural language teaching paradigm for nonverbal autistic children. *Journal of Autism and Developmental Disorders, 17,* 187-200.

Koegel, R. L., & Koegel, L.K (2006). *Pivotal Response Treatments for Autism: Communication, Social, and Academic Development*. Baltimore, MD: Paul H Brookes Publishing.

Koegel, R. L., Koegel, L. K., & Brookman, L. I. (2003). Empirically supported pivotal response interventions for children with autism. In A. E Kazdin & J.R. Weisz (Eds). *Evidence-based psychotherapies for children and adolescents* (PP.341- 357), New York, NY: Guilford Press.

Krebs, M. L., McDaniel, D. M., & Neeley, R. A. (2010). The effects of peer training on the social interactions of children with autism spectrum disorders. *Education*, *131*(2), 393.

Lang, R., O'Reilly, M., Rispoli, M., Shogren, K., Machalicek, W., Sigafoos, J., & Regester, A. (2009). Review of interventions to increase functional and symbolic play in children with autism. *Education and Training in Developmental Disabilities*, 481-492.

Lee, S. H., Simpson, R. L., & Shogren, K. A. (2007). Effects and implications of self-management for students with autism a meta-analysis. *Focus on Autism and Other Developmental Disabilities*, *22*(1), 2-13.

Litras, S., Moore, D. W., & Anderson, A. (2010). Using video self-modelled social stories to teach social skills to a young child with autism. *Autism Research and Treatment*, 2010834979. doi:10.1155/2010/834979.

Lord, C., Risi, S., DiLavore, P., Shulman, C., Thurm, A., & Pickles, A. (2006). Autism from two to nine. *Archives of General Psychiatry, 63*(6), 694–701. doi:10.1001/archpsyc.63.6.694

Maione, L., & Mirenda, P. (2006). Effects of video modeling and video feedback on peer directed social language skills of a child with autism. *Journal of Positive Behavior Interventions*, *8*(2), 106-118.

MacDonald, R., Clark, M., Garrigan, E., & Vangala, M. (2005). Using video modeling to teach pretend play to children with autism. *Behavioral Interventions*, *20*(4), 225-238.

MacDonald, R., Sacramone, S., Mansfield, R., Wiltz, K., & Ahearn, W. H. (2009). Using video modeling to teach reciprocal pretend play to children with autism. *Journal of Applied Behavior Analysis*, *42*(1), 43-55.

National Autism Center (2009). National standards report. Randolph, MA: Author.

National Professional Development Center on Autism Spectrum Disorder (2011). *Evidenced based practice: Video modeling.* Retrieved from: http://autismpdc.fpg.unc.edu/content/video-modeling (December 2013)

Nikopoulos, C. K., & Keenan, M. (2003). Promoting social initiation in children with autism using video modeling. *Behavioral interventions*, *18*(2), 87-108.

Parker, R. I., Vannest, K. J., & Davis, J. L. (2011). Effect size in single-case research: A review of nine nonoverlap techniques. *Behavior Modification*, *35*(4), 303-322.

Pierce, K., & Schreibman, L. (1995). Increasing complex social behaviors in children with autism: effects of peer-implemented pivotal response training. *Journal of applied behavior analysis, 28*(3), 285.

Plavnick, J. B., & Ferreri, S. J. (2012). Collateral effects of mand training for children with autism. *Research in Autism Spectrum Disorders*, *6*(4), 1366-1376.

Rehfeldt, R. A., Dahman, D., Young, A., Cherry, H., & Davis, P. (2003). Teaching a simple meal preparation skill to adults with moderate and severe mental retardation using video modeling. *Behavioral interventions, 18*(3), 209-218.

Sansosti, F. J., & Powell-Smith, K. A. (2006). Using social stories to improve the social behavior of children with Asperger syndrome. *Journal of Positive Behavior Interventions*, *8*(1), 43-57.

Scheflen, S., Freeman, S. N., & Paparella, T. (2012). Using video modeling to teach young children with autism developmentally appropriate play and connected speech. *Education and Training in Autism and Developmental Disabilities, 47*(3), 302-318.

Sherer, M., Pierce, K. L., Paredes, S., Kisacky, K. L., Ingersoll, B., & Schreibman, L. (2001). Enhancing conversation skills in children with autism via video technology which is better, "self" or "other" as a model? *Behavior modification*, *25*(1), 140-158.

Shipley-Benamou, R., Lutzker, J. R., & Taubman, M. (2002). Teaching daily living skills to children with autism through instructional video modeling. *Journal of Positive Behavior Interventions*, *4*(3), 166-177.

Shrestha, A., Anderson, A., & Moore, D. W. (2013). Using point-of-view video modelling and forward chaining to teach a functional self-help skill to a child with autism. *Journal of Physical Disability*, *22*, 157–167.

Sperry, L., Neitzel, J., & Engelhardt-Wells, K. (2010). Peer-mediated instruction and intervention strategies for students with autism spectrum disorders. *Preventing school failure, 54*(4), 256-264.

Stahmer, A. C., & Gist, K. (2001). The effects of an accelerated parent education program on technique mastery and child outcome. *Journal of Positive Behavior Interventions*, *3*(2), 75-82.

Stahmer, A. C., Ingersoll, B., & Carter, C. (2003). Behavioral approaches to promoting play. *Autism*, *7*(4), 401-413.

Stahmer, A. C., & Schreibman, L. (1992). Teaching children with autism appropriate play in unsupervised environments using a self-management treatment package. *Journal of Applied Behavior Analysis, 25*(2), 447.

Stahmer, A. C. (1995). Teaching symbolic play skills to children with autism using pivotal response training. *Journal of autism and developmental disorders*, *25*(2), 123-141.

Taylor, B. A., Levin, L., & Jasper, S. (1999). Increasing play-related statements in children with autism toward their siblings: Effects of video modeling. *Journal of Developmental and Physical Disabilities, 11*(3), 253-264.

Wert, B. Y., & Neisworth, J. T. (2003). Effects of video self-modeling on spontaneous requesting in children with autism. *Journal of positive behavior interventions*, *5*(1), 30-34.

Wilson, K. P. (2013). Incorporating video modeling into a school-based intervention for students with autism spectrum disorders. *Language, Speech, and Hearing Services in Schools*, *44*(1), 105-117.

Wingate, M., Kirby, R. S., Pettygrove, S., Cunniff, C., Schulz, E., Ghosh, T., & Yeargin-Allsopp, M. (2014). Prevalence of autism spectrum disorder among children aged 8 years-autism and developmental disabilities monitoring network, 11 sites, United States, 2010. *MMWR Surveillance Summaries*, *63*(2).

Wolfe, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis*, *11*, 203–214.

Losinski, M., Wiseman, N., White, S. A., & Balluch, F. (2015). A Meta-analysis of video-modeling based interventions for reduction of challenging behaviors for students with EBD. *The Journal of Special Education*, 0022466915602493.

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Table1.
Summary of studies

Authors	Participants	Target behaviors	Intervention/Model Duration	Effect size
Apple, Billingsley & Schwartz (2005)	2 children with autism aged 5 years	compliment giving behaviors	classroom peers and adults3 times/week	Video Modeling: .71 Video Modeling + Reinforcement: 1.00
Boudreau & D' Entremont (2010)	2 children with autism aged 4 years	pretend play skills related to particular toy sets	adult/ 22 sessions for participant 1 and 25 sessions for participant 2	Modelled actions: 1.00 Unmodelled actions: .51. Modelled verbalization: .96. Unmodelled verbalization: .45
Buggey (2012)	3 children with autism aged 3 to 4 years	social initiation during play	participants/ 15-minute daily observation	Initiations: .55
Cardon (2012)	4 children with autism aged 2 to 3	imitation skills	caregivers and participant's siblings 12 sessions (3 times/week).	Imitated actions: .97
Cihak et al (2012)	4 children with autism aged 3 years	Independent communicative initiations	peer/ three 20-30 second videos	Video Modeling + PECS:1 PECS: .96
D'Ateno, Mangiapanello & Taylor (2003)	1 child with autism aged 3 years	acquisition of motor and verbal play sequences	adult/ each session is 5 minutes	Verbal: .89 Motor: .82
Gena, Couloura & Kymissis (2005)	3 children with autism aged 3 – 5 years	affective responses	peer/ 2-4 times/week	Training trial: .80 Probe trial: .80

Authors	Participants	Target behaviors	Intervention/Model Duration	Effect size
Hine & Wolery (2006)	2 children with autism aged 2-3 years	pretend play actions	adult/15-minute daily	Gardening: .81 Cooking: .73
Kleeberger & Mirenda (2008)	1 child with autism aged 4 years	imitation skills during song and play activities	adults/ daily for 30 to 60 minutes	Video Modeling: .67 Video Modeling + Highlighting: .62 Video Modeling + Highlighting + Prompting + Reinforcement: 1.00
Litras, Moore & Anderson (2010)	1 child with autism aged 3 years	greeting, inviting to play and contingent responding	peer and parents and presented in the form of animated puppets	Scripted social initiations: .96 Generalized social initiations: .91
MacDonald et al., (2005)	1 child with PDD-Autism aged 4 years	verbalization and play actions	adult/ 4 minutes of play	Action: .97 Verbalization: 1
MacDonald, Sacramone, Mansfield, Wiltz & Ahearn (2009)	1 child with autism aged 5 years	reciprocal pretend play repertoires	adults/ watched videos twice and allowed 4 minutes of play	Action: .94 Verbalization: .98
Maione & Mirenda (2006)	1 child with autism aged 5 years	social interaction skills	adults/ 15-minute activity sessions2-3 times/week	Video Modeling: .816 Video Modeling + Video Feedback: .956
Plavnick (2012)	1 child with autism aged 4 years	mand acquisition	peer/ 5-10 trials. 3 in a day sessions	Attending: 1.00 Imitating: .97

Authors	Participants	Target behaviors	Intervention/Model	Effect size

			Duration	
Plavnick & Ferreri (2011)	3 children with autism aged 4 years	mand acquisition	peer/ 10 trials of video modeling conditions	Function based: .92 Non-function: .63
Scheflen, Freeman & Paparella (2012)	4 children with autism aged 2-3 years	Appropriate play skills and connected speech	2nd author/ twice weekly for 15 minutes	Play: .95 Instruction: .92
Sherer et al. (2001)	2 children with autism aged 4-5 years	appropriate responses to conversational questions	self and peer/ 22 sessions for participant 1 and 18 Sessions for participant 2	self: .73 others: .81
Shipley-Benamou (2002)	3 children with autism aged 5 years	functional living skills	primary researcher/ sessions typically ran approximately 15-20 minutes	Mailing a letter: .90 Table setting: .92 Pet care: 1.00
Shrestha, Anderson & Moore (2013)	1 child with autism aged 4 years	self-serving afternoon snacks	participant's mom/ 6 sessions in 3 phases	Independent steps: .98
Tereshko, MacDonald and Ahearn (2009)	1 child with autism aged 4 years	imitate response chains	Adult/sessions were run daily. Participant view 1 step of video. modeling 2 consecutive times	Toy A: .92 Toy B: .97 Toy C: .96 Toy D: 1.00
Wert & Neisworth 2003	4 children with autism aged 4 -5 years	spontaneous requesting	self/ one time each day for 5 consecutive school days within 60 minutes of school attendance	Video Self-modeling: 1.00
Wilson (2013)	4 children with autism aged 3-5 years	Social communication behavior	teacher and teacher assistant/ video and in vivo were 3 minutes, 3 times per week for 5 sessions	In vivo: .57 Video: .65

Table 2
Methodological parameters

Authors	Interventions	IOA	PI	SV	M	G
Apple, Billingsley & Schwartz (2005)	Exp.1: a) Video Modeling b) video modeling +reinforcement c) reinforcement only Exp:2: self-management	Yes	Yes	Yes	No	Yes
Boudreau & D' Entremont (2010)	Video modeling	Yes	Yes	Yes	Yes	Yes
Buggey (2012)	Video self-modeling	Yes	No	yes	No	No
Cardon (2012)	Video modeling	No	Yes	No	Yes	Yes
Cihak et al (2012)	PEC+ Video modeling	Yes	Yes	Yes	No	No
D'Ateno, Mangiapanello & Taylor (2003	Video modeling	Yes	No	No	No	No
Gena, Couloura & Kymissis (2005)	Video modeling And in vivo	Yes	No	No	Yes	Yes
Hine & Wolery (2006)	Video modeling	Yes	Yes	Yes	Yes	Yes
Kleeberger & Mirenda (2008	Video modeling	Yes	Yes	No	No	No
Litras, Moore & Anderson (2010)	Video self-modeling	Yes	Yes	Yes	Yes	Yes
MacDonald et al., (2005)	Video modeling	Yes	No	No	No	Yes
MacDonald, Sacramone, Mansfield, Wiltz & Ahearn (2009)	Video modeling	Yes	No	No	Yes	No
Maione & Mirenda (2006)	Video modeling	Yes	Yes	No	Yes	No
Plavnick (2012)	Video modeling	Yes	No	No	Yes	No
Plavnick & Ferreri (2011)	Video modeling	Yes	Yes	Yes	Yes	Yes
Scheflen, Freeman & Paparella (2012)	Video modeling	No	Yes	Yes	Yes	Yes
Sherer et al. (2001)	Self-modeling + modeling	No	No	No	Yes	Yes

Authors	Interventions	IOA	PI	SV	M	G
Shipley-Benamou (2002)	Video modeling	Yes	No	No	Yes	Yes
Shrestha, Anderson & Moore (2013)	Video modeling And verbal prompts	Yes	Yes	Yes	Yes	Yes
Tereshko, MacDonald and Ahearn (2009)	Video modeling	Yes	No	No	No	Yes
Wert & Neisworth 2003	Video Self-modeling	Yes	No	No	Yes	Yes
Wilson (2013)	Video and in vivo	Yes	Yes	No	Yes	No