Exceptional Children

Vol. 80, No. 1, pp. 67-83.

Effects of Video-Based Group Instruction for Adolescents With Autism Spectrum Disorder

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ABSTRACT: *Impairment in social interaction is a defining characteristic of individuals diagnosed with autism spectrum disorder (ASD). This can be especially challenging for adolescents as demands of social interaction increase in difficulty. Despite the need for effective social skills instruction, there are few empirically validated procedures for teaching social skills to adolescents with ASD. The present investigation evaluated the effects of a social skills training package centered around video-based group instruction (VGI) on the acquisition of complex social skills by 4 adolescents with ASD. A multiple probe across behaviors design demonstrated the effectiveness of the 3-month training package for teaching new social skills. The results suggest VGI can be an effective and efficient approach for teaching complex social behavior to adolescents with ASD.*

Deficits in social skills are a core characteristic of autism spectrum disorder (ASD) and can negatively affect relationships, academics, employment opportunities, independence, and mental health (Bellini, Peters, Benner, & Hopf, 2007). These deficits can be especially difficult for adolescents with ASD because social demands in high school require frequent complex social interactions with a variety of social partners across numerous contexts (Locke, Ishijima, Kasari, & London, 2010). Although social skills training can promote social functioning during adolescence and into adulthood, very few social skills treatments have been identified for this age group (Reichow & Volkmar, 2010). After conducting a rigorous review of social skills treatment research, Reichow and Volkmar identified only three high-quality experimental studies published between 2001 and

2008 targeting social skills treatments for individuals with ASD above 13 years of age. The complexity of social skills required for adolescent interactions combined with relatively few empirical studies documenting effective interventions for adolescents with ASD suggest a need for interventions that lead to the acquisition or improvement of complex social behavior for this group.

COMPLEX SOCIAL BEHAVIOR

A terminological distinction between complex and basic social behavior has been made in the ASD intervention research literature (LeBlanc et al., 2003; Pierce & Schreibman, 1995), though an operational definition for this distinction remains tenuous. We define basic social skills as behaviors consisting of an isolated response to a specific stimulus, such as saying "Hey" when a peer says "Hi." Similarly, a situation wherein an individual with ASD sees a peer playing with a toy and then asks for a turn with the toy would be classified as a basic social skill. Complex social behavior is then defined as a situation where an individual combines multiple responses (i.e., behavioral chain) or engages in a response that facilitates ongoing social interaction. To change the initial example to a complex behavior, additional response requirements could be added such as requiring that the child look and walk toward his peer, stop within 0.5 m to 1.0 m of his peer, and raise his hand to give a high five while saying "Hello." An example of a complex social behavior that facilitates ongoing social interaction would be when the student says "Hey" and asks a follow-up question such as "Did you see the game last night?"

Complex social behaviors tend to be more difficult to teach individuals with ASD for a number of reasons. First, a complex behavior may require the coordination of multiple responses into a behavioral chain. For example, when first teaching a child with ASD to ask to play with a peer, instructors might teach the child the basic behavior of approaching a peer and asking for a turn with a toy using a simple phrase such as "Can I have a turn?" However, in order to increase the odds of success (i.e., obtaining the turn) or to promote ongoing social interaction, an additional response component, such as getting attention by saying "Hi there" or ensuring that the child with ASD sits down near the peer after obtaining the toy, needs to be taught. In addition, complex behaviors may require the child with ASD to assess situations from the perspective of another person, which is often a skill deficit for this group (Baron-Cohen, Leslie, & Frith, 1985). Last, the natural consequence for many complex social behaviors is additional social interaction (e.g., conversation), which may not be a reinforcing consequence and therefore requires additional consideration of motivating factors necessary to evoke the behavior (e.g., Sarakoff, Taylor, & Poulson, 2001).

Reeve, Reeve, Townsend, and Poulson (2007) provide an example of teaching complex behavior by teaching primary-aged children (i.e., 5 to 6 years old) with ASD to offer help to another person in distress using an intervention package consisting of video modeling, prompting, and reinforcement. Offering help meets the criteria for a complex social skill because it requires a child to discriminate the affect of another individual to determine that help is needed, emit a statement to offer help, and perform a series of motor movements consistent with the help that was needed and offered (e.g., looking for a missing item). Despite no instances of helping behavior during baseline, all four of the participants learned to appropriately offer help at a high level of accuracy after receiving the intervention package. This suggests individuals with ASD can be taught complex social behavior, though additional research is needed with a specific emphasis on effective strategies for adolescents with ASD.

VIDEO MODELING INTERVENTIONS

As demonstrated by Reeve et al. (2007), video modeling is an instructional methodology that might be effective for teaching complex social skills to individuals with ASD. Video modeling involves displaying a video of an actor performing a target behavior prior to the opportunity for the learner to perform the response (Bellini & Akullian, 2007). Video modeling has been used with individuals with ASD of all ages and to teach a

wide range of skills (Rayner, Denholm, & Sigafoos, 2009). There are relatively few applications of video modeling to adolescents with ASD, though several features of the intervention suggest it may be ideal for teaching complex social behavior to this group.

First, the video can be edited in such a way as to remove excess stimuli that may interfere with learning (Bellini & Akullian, 2007). This can reduce the chances of participants focusing on environmental aspects that are not relevant to the skill, as is common when live modeling is used to teach new behavior. Second, some individuals with ASD demonstrate a preference for video and may be more likely to attend when information is presented via innovative technology (Charlop-Christy, Le, & Freeman, 2000). Third, participants can observe the same video multiple times and see explicit consequences that occur as a result of the behavior. This is an advantage over live modeling because it is difficult to ensure a similar level of consistency from people performing live; observing the relation between the target behavior and environmental consequences appears to improve learning outcomes for some individuals with ASD (Plavnick & Ferreri, 2011). Last, multiple exemplars of a behavior can be developed and shown relatively easily via video in order to promote acquisition of a concept as opposed to rote performance of an isolated skill (Plavnick & Ferreri, 2011).

The extant literature on video modeling tends to be biased toward young children with ASD, though a handful of studies has shown that adolescents can benefit from this approach as well (Allen, Wallace, Renes, Bowen, & Burke, 2010; Haring, Kennedy, Adams, & Pitts-Conway, 1987; Mechling, Pridgen, & Cronin, 2005). When used with adolescents, the dependent variable is typically a functional skill with less data demonstrating the effects of video modeling on social behavior. In an exception to this trend, Allen et al. taught adolescents and adults with ASD to engage in gestural interactions with retail customers while wearing a WalkAround costume (i.e., full body costume with head and face covered similar to a mascot uniform). After viewing the video model, participants demonstrated increased levels of the gestural behaviors modeled in the video. Although the researchers required that multiple gestures be performed within one 15-s interval, each target gesture was generally a basic social behavior because it required an isolated response (i.e., the gesture) as opposed to a series of responses forming a behavioral chain. Additional research is needed to establish video modeling as a methodology for teaching complex behavior to adolescents with ASD.

GROUP INSTRUCTION

An additional consideration for teaching social skills to adolescents with ASD is that the procedures must be practical to implement in the environments where services are typically provided (i.e., public schools). This consideration often requires that students be taught in a group (i.e., involving three or more students at a time) rather than individual instructional arrangements. Group instruction has been used to teach social skills to young children (Kroeger, Schultz, & Newsom, 2007), cooking skills to school-aged students (Tekin-Iftar & Birkan, 2009), and a variety of academic skills to individuals with ASD of all ages (e.g., Ledford, Gast, Luscre, & Ayers, 2008). Effective group instructional arrangements are especially important for school-aged individuals with ASD because diminishing resources for this age range limit the use of more commonly researched one-to-one instructional methods.

One approach to group instruction that may be particularly beneficial is to use video modeling as part of the teaching procedures. The rationale for this approach is that children with ASD may demonstrate increased levels of attending to and a preference for learning from video (Charlop-Christy et al., 2000). Instruction via video could therefore ease the task of ensuring participants attend to relevant instructional features and be leveraged to deliver instruction to multiple students at one time. Although video modeling has occasionally been used within a group instructional context (e.g., Kroeger et al., 2007), there are no investigations of video modeling as a methodology for teaching complex social behavior to multiple adolescents with ASD at one time, a scenario for which effective interventions are clearly needed (Reichow & Volkmar, 2010). The purpose of the present investigation was therefore

to begin examining the efficacy of a practice with video modeling as a core component to meet the demands associated with teaching social behavior to adolescents with ASD. Our specific research question was as follows: does video-based group instruction (VGI), a video modeling intervention delivered simultaneously to four participants, lead to the acquisition of complex social behavior for adolescents with ASD?

The purpose of the present investigation was to examine the efficacy of video-based group instruction, a practice with video modeling as a core component, to meet the demands associated with teaching social behavior to adolescents with ASD.

METHOD

Participants

After obtaining approval from the university Institutional Review Board to carry out the project, the experimenters recruited participants through an electronic mail advertisement disseminated by a local agency that served individuals with ASD and their families. The first four families to complete an initial application and meet enrollment criteria were accepted for participation. To be enrolled in the study, adolescents had to (a) have a prior diagnosis of ASD from a licensed psychologist or psychiatrist outside of the context of the research study; (b) be between 13 to 17 years old; (c) demonstrate the ability to vocally request or comment, attend to a television screen, and follow one-step directions during a brief screening prior to the investigation; and (d) agree to participate in two sessions per week over 3 months.

The Autism Social Skills Profile (Bellini, 2006) was administered to the parents of all participants to obtain information about prosocial deficits and problematic behaviors that may interfere with social interaction. The instrument includes a series of questions that a rater answers on a 4-point rating scale; a rating of 1 indicates the participant never engages in a particular behavior, and a rating of 4 indicates the participant very often engages in a particular behavior. Parent ratings indicated participants never or infrequently emitted the following behaviors targeted for the present study: inviting peers to join activities, asking to join peers in activities, asking about others, offering assistance, and maintaining conversations.

Vincent was a 14-year-old male diagnosed with ASD, obsessive compulsive disorder, and a mild to moderate intellectual disability. He received educational services via home-based one-to-one instruction supervised by a licensed speech and language pathologist and delivered by undergraduate students in speech and language pathology and social work. Vincent tested in the extremely low range of functioning on the reading, math, and written language subtests of the Woodcock Johnson Tests of Achievement, Third Edition (Woodcock, McGrew, & Mather, 2001, 2007). His standard scores on the Peabody Picture Vocabulary Test, Fourth Edition (Dunn & Dunn, 2007) placed him in the low range when compared to similar aged peers. He tested in the very low range of functioning on the Adaptive Battery Assessment System, Second Edition (Harrison & Oakland, 2003) and parent ratings on the Behavior Assessment System for Children (Reynolds & Kamphaus, 1992) indicated clinically significant cause for concern in the general areas of externalizing and adaptive behavior.

Baker was a 13-year-old male diagnosed with ASD. He attended his neighborhood public high school where he received educational services in a self-contained classroom for students with a range of developmental disabilities. His standard score on the Wechsler Intelligence Scale for Children, Fourth Edition placed him within the range of a mild intellectual disability. His standard scores on the Scales of Independent Behavior placed him in the low range of adaptive functioning when compared to similar aged peers.

Greta was a 13-year-old female who attended a public high school where she received educational services in a self-contained classroom for individuals with a variety of disabilities. She was diagnosed with ASD and a moderate intellectual disability. Her standard scores on the Oral and Written Language Scales and the Test of Pragmatic Language placed her in the very low range of language when compared to similar-aged peers.

Inez was a 16-year-old female who was diagnosed with ASD. Inez received educational services in her home and her mother was her instructor. Inez did not have a recent psychological evaluation. She could follow multistep instructions and answer simple questions. She did not independently initiate interactions or ask questions of others at the start of the study.

Setting, Instructor, and Materials

The study was conducted in a school classroom after students and staff had left the building at the end of the school day. The room was 8 m × 10 m with tables and chairs placed in the center for group participants and the instructor. An additional table with two chairs on opposite sides was set up in the corner of the room to facilitate social interactions between two participants at one time. A video camera was placed on a tripod in the opposite corner to record group sessions. The primary instructor for social skills groups was a master's level teacher who had previous experience delivering one-to-one behavioral programming to individuals with ASD. The first author, a Postdoctoral Fellow in Special Education, was the instructor for the first two meetings during the baseline and video modeling phases and the first meeting during the video fading phase to provide a model of implementation for the primary instructor.

A variety of technological devices were utilized in this study. A laptop computer or an Apple iPad was used to display video sequences during instructional periods. Computers, an iPod Touch, an iPad, games, and drawing utensils were provided to participants as preferred activities during breaks. Items to facilitate cooperative learning situations, such as puzzles, games, and books, were used during structured group activities. Paper and pencil were used by facilitators to record data and to create textual prompts for participants to read during group sessions. In addition, edible snacks (e.g., crackers, cookies, goldfish) and nonelectronic activities (e.g., puzzles, games) were used when indicated by preference assessments.

Experimental Design

A multiple probe (Horner & Baer, 1978) across behaviors design was used to assess the effects of VGI on target responding. The independent variable was sequentially administered to each target behavior (i.e., social domain) of an individual participant, which produced three staggered comparisons of intervention and baseline conditions for each participant. Based on criteria for identifying causal, or functional, relations in single-case research (Kratochwill et al., 2010), a single participant represents a complete experiment with additional participants demonstrating replications of the original experiment.

Dependent Measures

Multiple target behaviors across the following social domains were measured for each participant: social initiations, social awareness, and reciprocal social interactions. Social initiations included two target behaviors: inviting peers to join an activity and joining an activity in progress. Social awareness also included two target behaviors: asking about the interests of others and offering assistance to others. Reciprocal social interactions was a single target behavior with two steps: participants had to maintain a conversation by answering a peer's question and extend the conversation by asking a peer a question or making an open-ended comment that invited a response from the social partner. Table 1 identifies, describes, and provides an example of each of the target behaviors within the selected domains and also indicates antecedents explicitly programmed by the instructor to evoke each target response.

Social Initiations. Inviting a peer to join an activity was defined as: approaching a peer and stopping within 0.5 m to 1.0 m, stating the peer's name to obtain attention, asking, "Would you like to play [name activity] with me?" and engaging with the peer in the identified game or activity. The phrasing of this question could vary slightly, though the essential components were (a) getting the peer's attention, (b) requesting and not demanding that the peer play with him, (c) stating the name of the activity, and (d) engaging in the identified activity with the peer. A nonexample of this behavior would be a demand such as "Come play with me."

The second behavior for the initiation domain was joining activities in progress. This behavior involved (a) approaching one or more

TABLE 1

Dependent Measures With Programmed Antecedents and Examples

Target Domain and Behaviors	*Definition*	*Antecedents*	*Example*
Social Initiations			
1. Inviting to join	Approaches peer, obtains peer's attention, and asks peer to join activity.	Desirable activities available (e.g., games, cards, books). Instructed by facilitator to ask a peer to play.	Target student approaches peer and says, "Hi [name], would you like to play Uno with me?"
2. Joining activity	Approaches peers engaged in activity, obtains peers' attention, and asks to join in activity.	One or more peers engaged in an activity (e.g., game, putting a puzzle together). Instructed by facilitator to join friends.	Target student approaches a group of peers involved in activity and says, "Hi guys! Can I play with you?"
Social Awareness			
1. Asking about the interest of others	Obtains peer's attention and asks a question concerning the interest of the peer.	Engaged in activity with social partner. Facilitator makes open-ended comment about peer (e.g., "Joey did something exciting today.").	Target student says, "Hey Joey, what did you do before group today?"
2. Offering assistance	Vocalize offer to help and engage in corresponding helping behavior.	Facilitator creates a situation where help is needed (e.g., spills drink) and vocalizes need for help (e.g., "This will take me forever to clean up!").	Target student says, "I can help you," and then engages in helping adult (e.g., getting towels to clean up mess).
Reciprocal Interactions			
1. Maintaining conversations	Responds to comment or question from social partner and asks a follow-up question or emits open-ended comment that invites response.	Social partner asks target student a question (e.g., about their favorite movie or book or about what they did this weekend).	After social partner asks target student what his/her favorite movie is, target peer responds, "My favorite movie is [movie name]. What is your favorite movie?"

peers involved in an activity, (b) emitting an attention-getting greeting (e.g., "Hi guys"), (c) asking to join in the activity (e.g., "Do you mind if I join you?"), and (d) joining the peers after receiving an affirmative response (e.g., peers were prompted to always say yes if this did not immediately occur). An example of this behavior would be for the focal participant to approach two peers who are putting a puzzle together.

Social Awareness. Asking about the interests of others included (a) getting the attention of another person when involved in an interactive activity, and (b) asking a specific question about a topic that is of interest to that person. Examples of questions included asking about a peer's favorite things (books, movies, games) or asking what the peer did last weekend.

Offering assistance to others was defined as vocalizing an offer to help (e.g., "Can I help you?") and engaging in a behavior that was similar to the behavior demonstrated by an adult social partner (e.g., cleaning a spilled liquid or locating an object) when the social partner emitted physical, affective, and vocal antecedents that

signaled the need for help (Reeve et al., 2007). Antecedent signals included dropping objects (e.g., deck of cards, game pieces), affective behaviors (e.g., deep sigh), and vocal complaints (e.g., "How will I ever get this cleaned up?").

Reciprocal Social Interactions. The reciprocal social interaction domain consisted of maintaining the give and take of conversation. This skill required two steps: (a) answering a question or making a comment in response to the initiation of another person, and (b) asking a follow-up question or making an open-ended comment that invited a response from the social partner. An example of this behavior is an adult asking the focal participant, "What did you do over the weekend?" The focal participant would respond by reporting about something she did over the weekend and then asking the adult, "What did you do last weekend?"

Measurement. Social targets were measured by observers who recorded the occurrence or nonoccurrence of the response following programmed antecedents (see Table 1). An occurrence was scored if the behavior occurred following the programmed antecedents during the baseline and video fading conditions and following the display of the video model and programmed antecedents in the VGI condition. Five to seven opportunities to perform each target behavior within each domain were provided during a training session.

The total correct responses were divided by the total response opportunities and multiplied by 100 to obtain a percentage for each domain during each session. The primary observer was a doctoral student in special education and was trained by the first author to record dependent measures to a criterion of 90% accuracy prior to collecting data. The first author was a second observer and independently recorded dependent measures across 48% of randomly selected sessions evenly distributed across conditions and behaviors. Interobserver agreement (IOA) was calculated using point-by-point agreement. Agreements or disagreements were scored for each trial and total agreements were divided by total agreements plus disagreements and multiplied by 100 to obtain a percentage. Mean IOA for complex initiations was 94% (range, 88%–100%) and 97% (range, 88%–100%) during baseline and VGI conditions, respectively. Mean IOA for social awareness behavior was 95% (range, 85%–100%) and 99% (range, 95%–100%) during baseline and VGI, respectively. Mean IOA for social reciprocity was 97% (range, 86%–100%) and 100% during baseline and VGI, respectively.

PROCEDURES

Preassessment. Once participants were selected, a series of assessments were administered to each participant. Informal interviews and the Autism Social Skills Profile were administered to parents of each participant to obtain information about the participant's social functioning. Interview questions pertained to social goals, strengths, areas of skill deficit, and specific behaviors that may interfere with positive social interactions. Parents were also asked to complete a preference survey in order to identify items that were likely to function as reinforcers for participants during group sessions. Each preference survey asked parents to rate preferences within and across the following areas: electronic activities, nonelectronic activities, sensory materials, and edible items. Each participant's two or three highest-rated preferences in each category were incorporated into social skills group meetings and were embedded within teaching trials (i.e., video clips) for participants. For example, if a participant preferred reading books about animals, a video clip during the social initiation domain depicted a model asking a peer to read a book about animals with him. Access to the same book or similar books about animals would then be available to the participant contingent on performing the target behavior (i.e., correctly asking a peer to read the book with him). Preferred stimuli were available during all conditions, though video clips were not displayed during baseline and rarely displayed during video fading.

Video Clip Creation. Three different video clips were generated to depict variations of each target behavior (i.e., 15 total videos). Video clips were 20-s to 30-s long and depicted male and female models between 16 and 25 years of age performing the functional components of target behaviors. A script of each video was developed prior to filming by the first author and models

were required to adhere to the script when filming.

The rationale for completing three video clips for each behavior was to program for generalization through the video equivalent of multiple exemplar training, a strategy that increases the likelihood of transferring stimulus control over behavior from training conditions to other environments (Ghezzi & Bishop, 2008). In this case, each of the three videos for a target behavior depicted different models, social partners, materials, and linguistic exemplars.

Another feature of the video clips was that naturally occurring consequences were embedded in the clips to depict the behavior-consequence relation via video prior to giving a participant the opportunity to perform the target behavior and experience a similar consequence. This strategy was the video modeling equivalent of embedding naturally occurring reinforcers into the teaching procedures, which is another procedure used to program for generalization (Ghezzi & Bishop, 2008). For the social initiation domain, participants viewed the model obtaining access to preferred items or activities. For the social awareness and reciprocal interaction domains, participants viewed a video of a model receiving gratitude (for offering help) or other forms of vocal attention (i.e., social partner talked to participant).

Baseline. Following assessments, the participants attended two 75-min social skills group meetings per week during all conditions. The first three meetings were introductory and functioned as a baseline during which experimenters (a) taught participants basic rules for the social skills group, such as following directions, sitting still, and looking at others during social interactions, and (b) measured current levels of target behaviors for each participant. Activities during the baseline social skills meetings involved alternating between teaching the rules and providing opportunities for participants to engage in targeted social behaviors. A behavioral skills teaching approach (Miltenberger, 2008) combined with a token economy system (Kazdin, 1982) was used to teach the social skills rules. Opportunities to demonstrate targeted social behavior were the focus of the present investigation and are described in greater detail in the following sections.

A baseline session involved the instructor creating five to seven opportunities for each participant to emit each of the identified target behaviors. Instructors created opportunities for participants to perform the target behaviors by engaging in antecedent behaviors that tend to evoke the target response (see Table 1). The instructor was the social partner for "offering help" and "maintaining conversation" trials because these behaviors required a specific social antecedent, such as demonstrating the need for help or initiating a conversation, that participants may not have emitted as planned. Peers were social partners for all other target behaviors. Regardless of social partner, there was no instruction or guidance provided to participants by instructors during the social interaction opportunities (described in the following sections).

Baseline sessions lasted 20 min to 30 min with the variance based on the amount of time it took to administer five to seven opportunities for each participant to engage in each of the targeted social behaviors across all three domains. One or two baseline sessions were administered during each of the first three social skills groups for a total of five baseline sessions for each participant prior to initiating training procedures for the first social domain. Participants and the facilitator sat around two rectangular tables that, when placed together, formed a 1.5 m $\times$ 1.5 m square. In some cases, one or more participants were sent to a similarly arranged area across the room to facilitate the various peer-to-peer interactions (e.g., two participants sent to table to play with a game and a third peer sent to ask if he could join them).

To initiate a trial, the facilitator provided the programmed antecedent(s) and waited 10 s to record whether the participant did or did not emit the target response within 10 s of the programmed antecedent stimuli. Explicit feedback and prompts were not provided during the baseline condition. If participants performed a target response during baseline, they experienced naturally occurring consequences; specifically, participants were able to engage in the specified social activity, received praise from the facilitator, or interacted with the facilitator depending on the domain targeted during a trial. Within 2 s to 3 s of the completion of the trial for one participant,

another participant was presented with the programmed antecedent stimuli and an opportunity to respond. This sequence was repeated until all participants had at least five opportunities to engage in all targeted behaviors.

Five initial baseline sessions were scheduled and administered to each participant except Inez, who was absent during the final baseline meeting and participated in only three baseline sessions. After the initial baseline sessions, video modeling was initiated for the first domain and probes for the remaining domains were conducted every four sessions (eight for Inez due to absences). In addition, three consecutive baseline probes were administered immediately before the application of video modeling to a specific domain. Administering baseline probes in this manner ensures stability of behavior under baseline conditions and rules out potential confounds such as maturation, history, or multitreatment interference (Kazdin, 2011).

VGI. Following the introductory meetings, the facilitators began teaching targeted social behavior to group members using VGI embedded within the 75-min social skills meeting. Two VGI sessions, each lasting 20 min to 25 min, were administered during every group meeting and allowed for explicit instruction and practice of target responses. Additional components of the social skills group meeting during the VGI condition included a brief (i.e., 5 min) review of rules, a 15-min structured group activity (e.g., games, puzzles), and a 5-min to 10-min meeting wrap-up with a snack.

During the first session, the facilitator introduced the first two target responses (complex initiation domain) by showing a video of neurotypical young adults engaging in the target behaviors. Participants had the same target behaviors such that a single video provided a model for all participants. The facilitator instructed participants to "watch the video on my iPad because you should do and say exactly what the people in the movie do and say when talking to friends." The facilitator then played the video clip while all participants looked toward the video screen at the same time. Immediately following each 20-s to 30-s video clip, participants were presented with an opportunity to perform the target behavior one at a time in the same manner described during baseline conditions. As in baseline, instructors were social partners for the "offering help" and "maintaining conversation" behaviors and peers were social partners for all other behaviors. In addition, no instruction or guidance to perform the target behavior other than the videos was provided during the VGI sessions.

If participants performed the target response, they (a) were able to engage in the specified social activity for the complex initiation domain, (b) received praise from the facilitator during the social awareness domain, or (c) interacted with the facilitator during the social reciprocity domain. If participants did not engage in the correct behavior, they did not experience any of the previous consequences and instead were told by the facilitator that it was a nice try but that next time they needed to change certain aspects of their behavior to perform the social response correctly. Following an incorrect response and feedback, the facilitator instructed participants to sit down at the main table and wait for their peers to finish. The group then viewed the target social behavior again until each participant had five to seven opportunities to demonstrate the target response. The initial social domain was taught using the procedures described previously until participants demonstrated an increasing trend or stable responding above 80% correct during the video modeling condition. At that time, additional domains were sequentially targeted using the same procedures and evaluation criteria.

An exception to the teaching procedures was made for Vincent due to errors in pronoun reversal identified during initial teaching trials. Specifically, Vincent would say "Can you join me?" instead of saying "Can I join you?" when asking to join peers in an activity. The facilitators therefore added a scripted prompt when teaching Vincent to ask to join peers in play. The script was a 6 cm × 6 cm piece of white paper with the words "can I" written on the paper in black ink. The script was presented on Vincent's first trial of asking to join for each session and only presented for additional trials during the session if a pronoun reversal occurred on the previous trial. If Vincent reversed pronouns but demonstrated every other component of the response requirement, his response was scored as correct and the consequence for correct responding was delivered. In order to

fade the script, the facilitator folded the script in half to start each session if Vincent demonstrated 100% accuracy during the previous session.

Video Fading. Once participants met mastery criteria for a skill, video modeling was faded using a progressive time delay (Walker, 2008); facilitators presented an opportunity to engage in the target behavior as in baseline and only showed the video after a 5-s delay if the participant did not perform the response. The delay was gradually increased in 5-s intervals until all participants performed the skill without viewing a video model. Acquired skills were probed periodically, in the same manner described during baseline conditions, to promote maintenance. Responses were scored correct in the video fading condition only when emitted prior to displaying the video model.

Social Validity. Parents of participants were asked to complete an anonymous satisfaction survey to identify the extent to which consumers were satisfied with the goals, procedures, and outcomes associated with the research study. The survey was developed by the first author and included questions specific to the present investigation. The survey asked parents the extent to which they "agreed," "slightly agreed," "were neutral," "slightly disagreed," or "disagreed" with questions related to the critical components of social validity (i.e., goals, process, outcomes) as identified by Wolf (1978).

Procedural Integrity. The first author developed component checklists that included items considered essential to the successful implementation of VGI. The first author and a research assistant coded videos of 20% of randomly selected VGI sessions to ensure facilitators implemented the intervention with fidelity. Mean levels of fidelity across all conditions was 92% (range, 87%–100%). Reliability across coders' procedural integrity ratings was 100%.

RESULTS

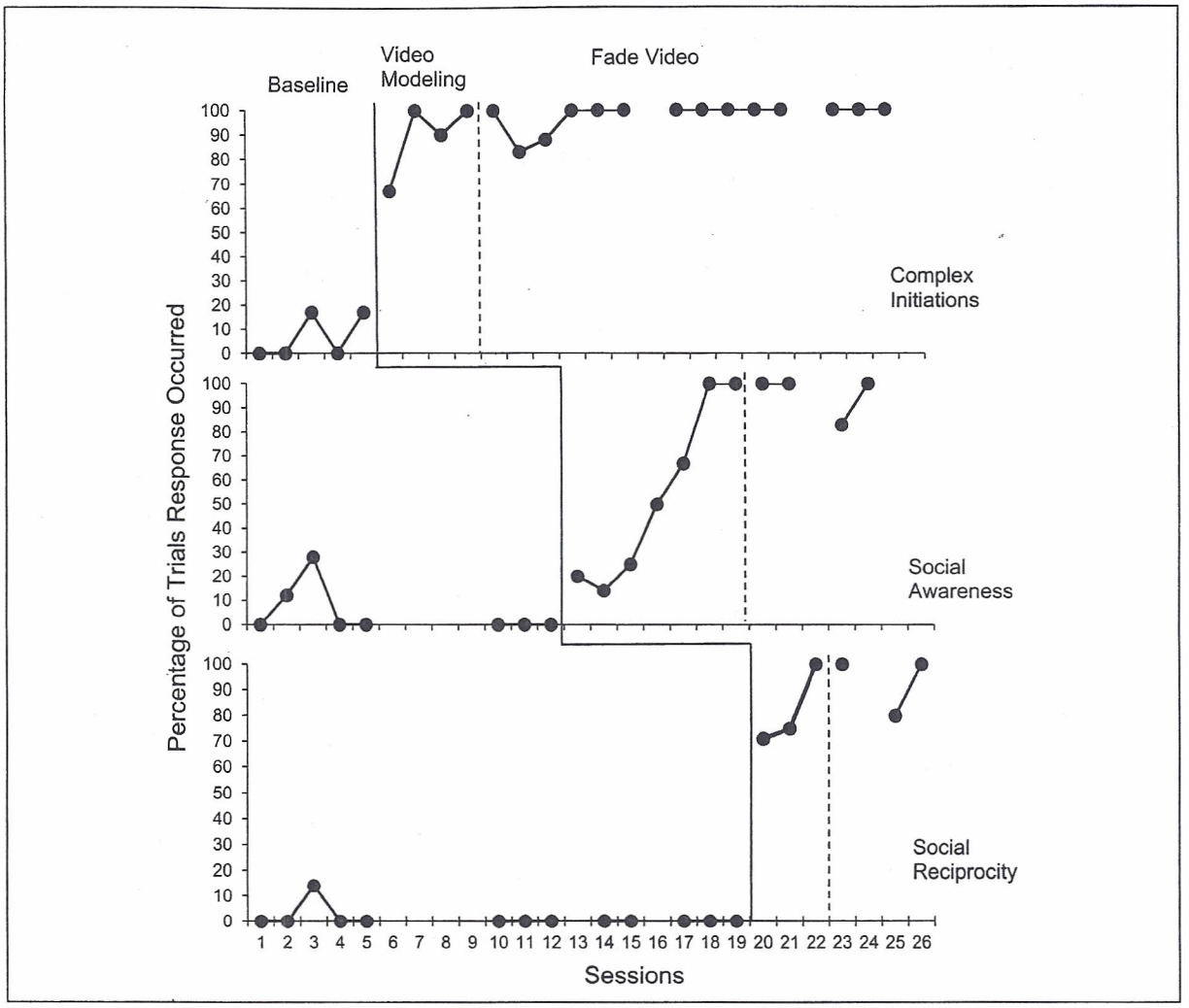
Results of VGI on social behavior for Vincent are displayed in Figure 1. Vincent demonstrated low levels of targeted behavior during baseline with a rapid increase observed during the VGI condition. He maintained responses when videos were faded across all targeted domains. Immediacy of effect was evident across all behaviors with either large magnitude of change or increasing trends observed quickly after the intervention was implemented. Behavior stabilized at high levels during the video modeling condition and remained stable at those levels during the video fading condition. Vincent demonstrated complex initiations for a mean of 6.8%, 89.3%, and 97.9% of trials during baseline, VGI, and video fading conditions, respectively. Vincent took slightly longer to acquire behaviors targeted in the social awareness domain than in the complex initiation domain. However, he demonstrated a clear change in level with mean responding of 5%, 53.1%, and 95.8% of trials during baseline, VGI, and video fading conditions, respectively. Vincent's pattern of reciprocal social interaction was similar to the complex initiation behaviors with mean percentage of reciprocal social interaction of 1.1%, 82%, and 93.3% during baseline, VGI, and video fading conditions, respectively.

Results of VGI on targeted social behavior for Baker are displayed in Figure 2. Similar to Vincent, the immediacy of effect is evident for Baker because he rapidly acquired and mastered targeted social behavior across all domains once VGI was implemented. Responding stabilized at high levels during the video modeling condition and was sustained during the video fading condition. Baker demonstrated complex initiations for a mean of 4.8%, 81.3%, and 97.2% of trials during baseline, VGI, and video fading conditions, respectively. Baker demonstrated a clear change in social awareness behavior with mean responding of 8.1%, 80.3%, and 100% of trials during baseline, VGI, and video fading conditions, respectively. Although the magnitude of change between the baseline and video modeling condition for social awareness was not as large as was observed for complex initiations, an immediate increasing trend was observed. Baker showed no reciprocal social interaction during baseline with levels increasing to means of 90% and 100% during VGI and video fading conditions, respectively. In addition, immediate effects were observed across variables and there were no overlapping data points

Results of VGI on targeted social behavior for Greta are displayed in Figure 3. Greta also

FIGURE 1

Percentage of Trials Vincent Performed Target Behaviors



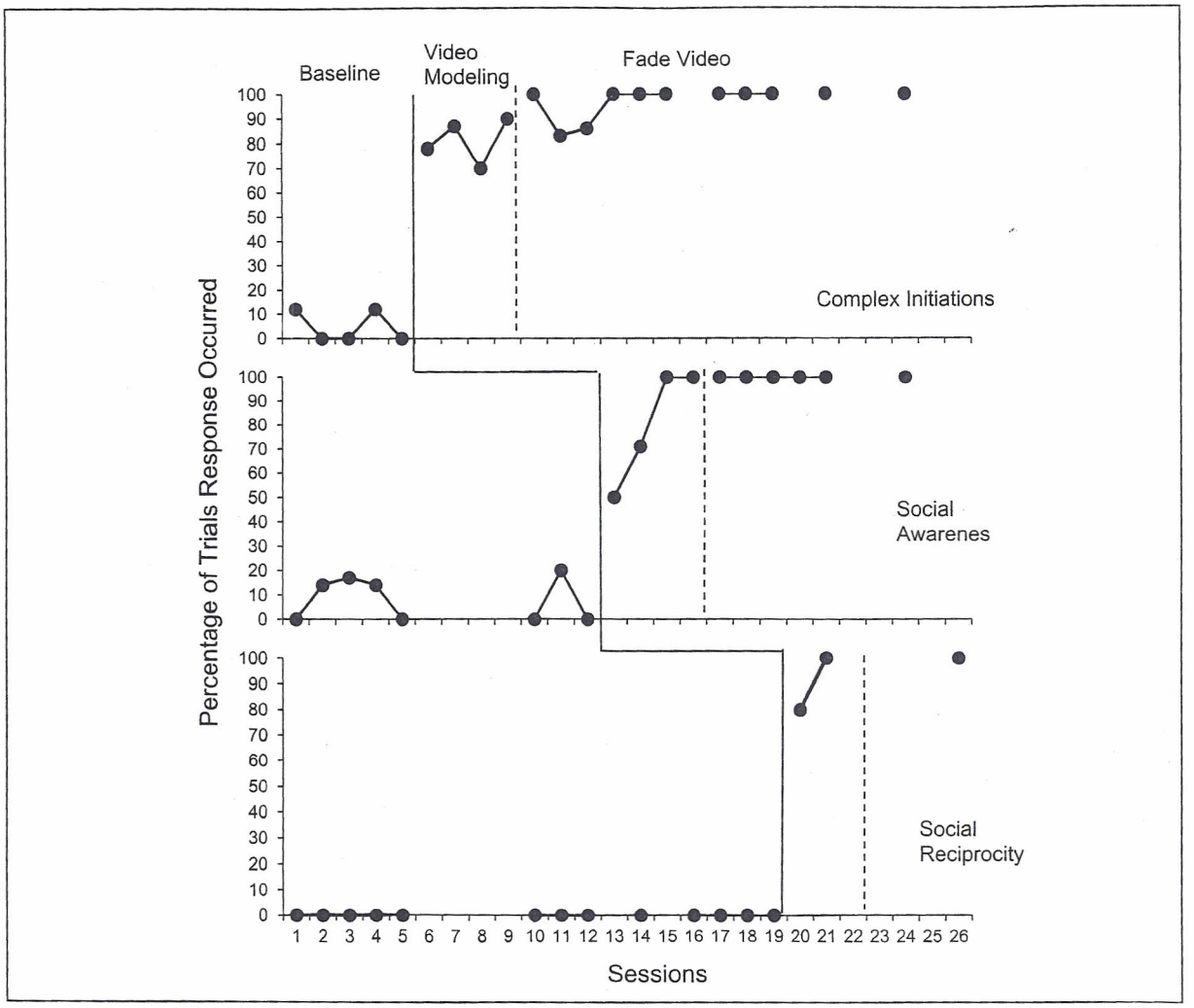
Note. Data points represent the percentage of trials Vincent accurately performed all components of the target social behaviors during baseline (without video), video modeling (with video), and video fading (without video) across each of the social skill domains.

acquired and mastered targeted social behavior across all domains once VGI was implemented. Immediacy of effect was demonstrated clearly for complex initiations and social reciprocity, and across variables, there were no overlapping data points. Greta demonstrated complex initiations for a mean of 6.8%, 91%, and 98.9% of trials during baseline, VGI, and video fading conditions, respectively. She met acquisition criteria for the social awareness behaviors by the fourth session and demonstrated mean responding of 12.1%, 64.5%, and 90% of trials during baseline, VGI, and video fading conditions, respectively. Greta showed no reciprocal social interaction during baseline with levels increasing to a mean of 88% and 93.3% during VGI and video fading conditions, respectively.

Results of VGI on social behavior for Inez are displayed in Figure 4. Inez demonstrated rapid acquisition and mastery of all targeted domains immediately upon implementation of VGI. Trends were difficult to ascertain due to limited data, but the immediacy of the effect, as well as no overlapping data, strengthen her results. She demonstrated complex initiations for a mean of 5.7%, 95.7%, and 100% of trials during baseline, VGI, and video fading conditions, respectively. Inez demonstrated a clear change in level of social awareness behavior with mean responding of 16%, 81%, and 100% of trials during baseline,

FIGURE 2

Percentage of Trials Baker Performed Target Behaviors



Note. Data points represent the percentage of trials Baker accurately performed all components of the target social behaviors during baseline (without video), video modeling (with video), and video fading (without video) across each of the social skill domains.

VGI, and video fading conditions, respectively. Inez demonstrated rapid change in social interaction with a mean percentage of 15.8%, 90.3%, and 94.3% during baseline, VGI, and video fading conditions, respectively.

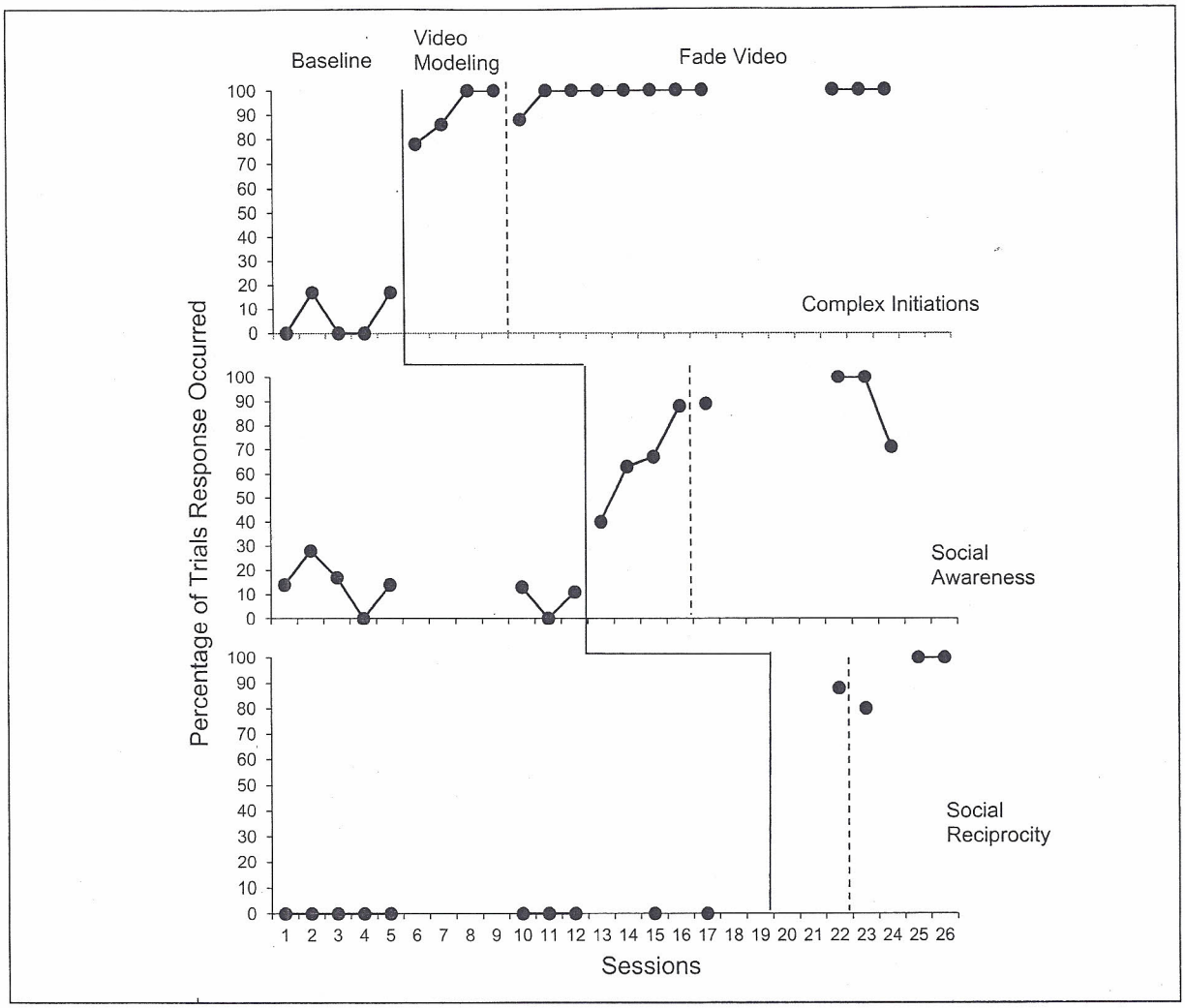
Based on the consumer satisfaction survey, parents indicated high levels of satisfaction with the procedures and outcomes of VGI. All parents responded with the most positive ratings for all survey questions. Write-in parent comments indicated that a participant started asking family members to play games together—a skill that had never before occurred at home—and another participant demonstrated an increase in initiating interactions and sustaining conversation. Consumers had no negative comments regarding the group.

DISCUSSION

All participants in the social skills group demonstrated a rapid increase in level of complex social behavior each time VGI was applied to a social domain. Participants also demonstrated the ability to independently engage in the social behaviors at a high level as the videos were faded. These results meet the criteria proposed by Kratochwill et al. (2010) for determining causal inference in single case designs in that a functional relation between VGI and the targeted social behaviors was

FIGURE 3

Percentage of Trials Greta Performed Target Behaviors



Note. Data points represent the percentage of trials Greta accurately performed all components of the target social behaviors during baseline (without video), video modeling (with video), and video fading (without video) across each of the social skill domains.

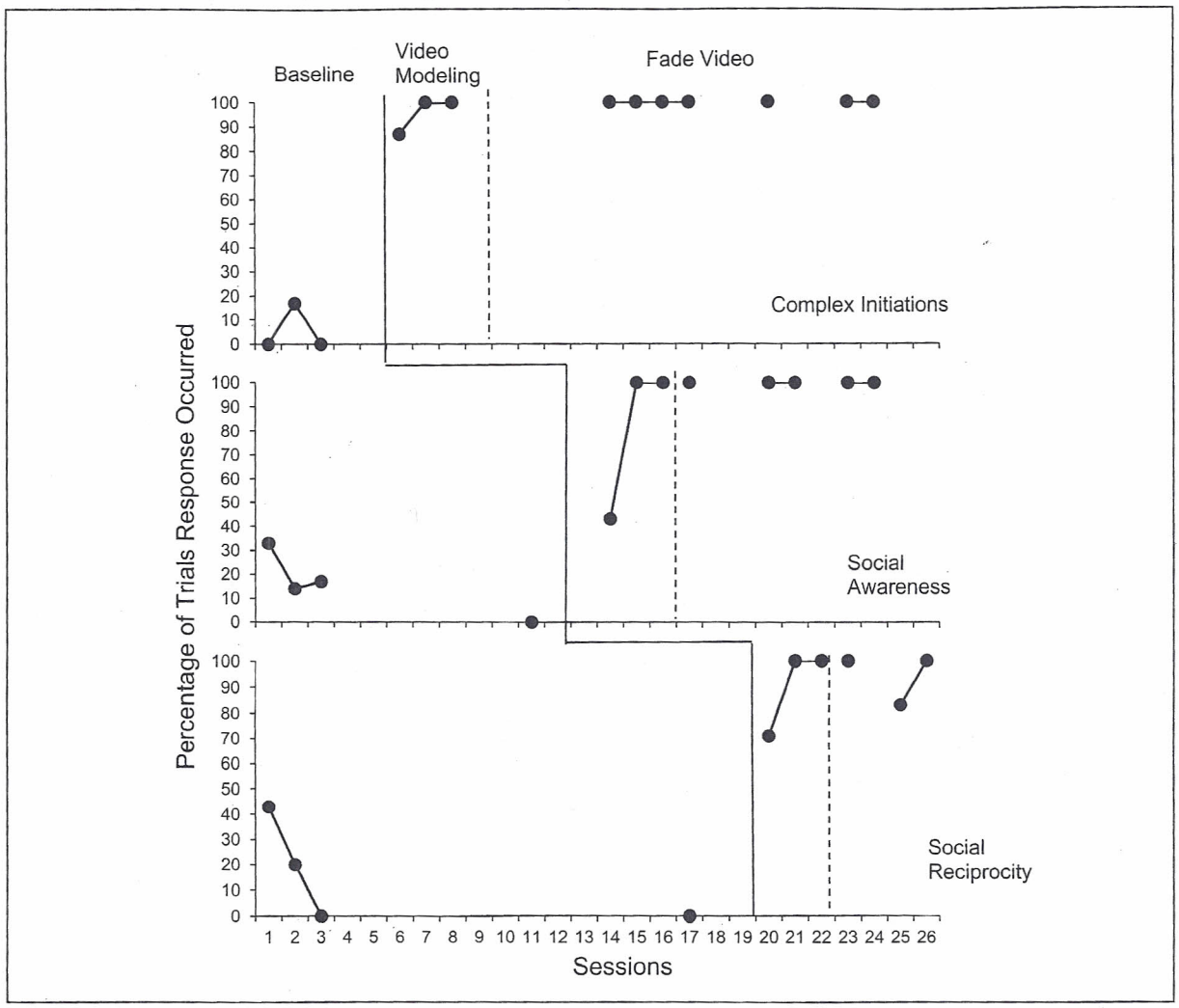
established for three behaviors at three points in time. These effects were demonstrated strongly for Vincent with replications across the remaining participants, though absences during baseline or intervention sessions for Baker, Greta, and Inez limit the strength of the functional relation for those participants. The results therefore suggest a clear functional relation between VGI and the acquisition of complex social behavior by adolescents with ASD as well as a need for additional replications across participants.

The results of this study offer several important contributions to previous research. First, the investigation shows that video modeling can be used to deliver instruction to multiple students at one time. This is important given the often-limited human resources in schools and increasing numbers of students with ASD. Whereas the majority of previous research in video modeling describes 1:1 staff to student ratios (e.g., Charlop-Christy et al., 2000; Plavnick & Ferreri, 2011), the present investigation led to positive outcomes with a 1:4 ratio. This provides an empirical validation of an instructional practice that, from a purely numerical standpoint, has potential for replication in many public school settings.

A second contribution of the study was the use of video modeling to teach complex social behavior to adolescents with ASD. Complex social behaviors are more difficult to teach than basic

FIGURE 4

Percentage of Trials Inez Performed Target Behaviors



Note. Data points represent the percentage of trials Inez accurately performed all components of the target social behaviors during baseline (without video), video modeling (with video), and video fading (without video) across each of the social skill domains. Reduced probes during baseline were the result of absences from group sessions.

social behaviors because they require multiple responses or involve consequences that may not be reinforcing (Pierce & Schreibman, 1995; Reeve et al., 2007). Nevertheless, video modeling led to an immediate change in the level of complex social behavior demonstrated by each participant. In 11 of 12 cases there were no overlapping data points with minimal overlap for Vincent in the social awareness domain. Despite low or in some cases no instances of the target response during baseline, participants demonstrated social responding above the 80% criterion usually within two or three VGI sessions, and never more than six, across all targeted domains. These findings suggest effective instruction can lead to rapid acquisition of skills such as reciprocal conversation and offering help for some individuals with ASD.

The rapid change in behavior speaks to the efficacy and efficiency of VGI, though more information is needed to understand how the intervention produces rapid behavior change. Specifically, the design of the present investigation was developed in order to increase the likelihood of video modeling being effective by embedding preferred observed consequences within the video of the first targeted domain. Plavnick and Ferreri (2011) found that including preferred consequences in video clips was functionally related to acquisition of the target response. This may be critical when teaching an individual via video

modeling for the first time, but might not be necessary to maintain because the video model may eventually become a discriminative stimulus for matched responding, similar to the process observed in generalized imitation (e.g., Young, Krantz, McClannahan, & Poulson, 1994).

All participants in the social skills group demonstrated a rapid increase in level of complex social behavior each time video-based group instruction was applied to a social domain.

The issue of sequencing target behaviors, and the related observed consequences, is an area in need of additional research because it suggests an important skill hierarchy for video modeling instruction and provides a blueprint for training a number of complex social skills using video modeling. Future research specific to this area should also include examinations to determine how often skills that involve preferred observed consequences, and response-contingent delivery of direct reinforcement, need to be included to maintain matched responding once it is acquired. Similar to early research that examined observed but not direct reinforcement (e.g., Kazdin, 1973), it is assumed that the stimulus control of the observed response would not be maintained without some schedule of direct reinforcement. If not systematically administered, video modeling could inadvertently lead to a conditional discrimination wherein matched responding occurs only when the video clip includes a preferred consequence.

The ability to teach the targeted skills without the use of prompts other than the video itself requires additional consideration. Many behavioral interventions for individuals with ASD utilize response prompts to ensure the behavior occurs and establish the response-reinforcer relation. Stimulus control is then transferred from the prompt to the natural environment through gradual fading. This process can be slow and, especially when vocal prompts are used, may promote prompt dependence, thereby decreasing independent responding across contexts (Charlop-Christy et al., 2000). Similar to previous applications of video modeling (D'Ateno, Mangiapanello, & Taylor, 2003; Plavnick & Ferreri, 2011), prompts other than the video were not used in the present investigation, and the video was faded with no adverse effects on response maintenance. The potential to eliminate response prompts has very important implications for delivering instruction to students with ASD. More research is needed in this area to better understand the advantages and disadvantages of such an approach.

The results of the study must be interpreted in light of the following limitations. First, it is possible that a participant acquired target skills by observing peer models within the group rather than the video models. For example, during the initial "offer help" trials, Vincent only offered to help an instructor in distress after one of his peers did so. Although this speaks to the benefit of group instruction, it is not clear whether he would have engaged in the response following video modeling only (i.e., without also observing live peers).

A second limitation is that the data only represent the extent to which participants demonstrated the targeted social skills within the social skills group context. There is some evidence to suggest that skills acquired within social skills groups tend not to generalize beyond the group context (Bellini et al., 2007). However, previous investigations did not specifically program for generalization as occurred in the present investigation (e.g., multiple exemplar training, naturally occurring reinforcers). Although parents reported that participants used the target behaviors in other settings, resources did not allow for direct observation of target behaviors in other social contexts (e.g., school, home). Future research should directly assess generalization of responding when using video modeling within social skills group interventions that specifically program for generalization. For example, an extension of the current study with probes for generalization in school and community based settings, or if necessary with the use of confederates in more controlled settings, would strengthen the efficacy of VGI.

VGI was an effective and efficient methodology for teaching complex social skills to adolescents with ASD in a manner that may be replicable in public school settings. The adult to student ratio is manageable and the treatment

dosage could likely be replicated, if not increased, within public school settings. It might be possible to implement VGI on a daily basis within a school setting, which could promote far-reaching gains across multiple social behaviors; the increased dosage may also facilitate generalization of social skills (Bellini et al., 2007). Further, the use of innovative technology allowed for a fast-paced and portable approach to intervention that seemed to capture participants' interest—a feat that can be difficult given the participants and subject matter. These features are consistent with the service delivery demands in public school settings and indicate the importance of future research examining VGI for a range of learners with ASD.

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Manuscript received November 2011; accepted June 2012.