

Effects of a School-Based Social Skills Training Program for Adolescents with Autism Spectrum Disorder and Intellectual Disability

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Abstract Social deficits are a core characteristic of individuals with autism spectrum disorders and co-occurring intellectual disabilities (ASD-ID). Despite persistence of these deficits into adolescence, few social skills interventions have been empirically evaluated for older individuals with ASD-ID. The present investigation adapted an efficacious protocol for adolescents with ASD, video-based group instruction (VGI), and extended the procedure to 4 adolescents in a public high school setting. A multiple probe across behaviors design demonstrated the effectiveness of VGI for teaching novel social behavior to three of the four participants, with mixed outcomes for the fourth participant. Long-term maintenance was observed for two participants, though generalization outcomes were mixed. The results support using VGI within high school curricula for some adolescents with ASD-ID.

Keywords Autism spectrum disorder · Group instruction · Intellectual disability · Observational learning · Social skills · Video modeling

Introduction

It is estimated that approximately 30 % of individuals with autism spectrum disorder (ASD) have a co-occurring intellectual disability (ASD-ID; Baio 2014). Individuals with ASD-ID often demonstrate minimal social interaction with others and require intensive instruction to acquire a basic repertoire of social skills (Walton and Ingersoll 2013). Although several social skills training procedures have been empirically validated for children with ASD-ID, social deficits persist into adolescence and adulthood, with minimal research examining effective social skill instruction for individuals above age 12 (Walton and Ingersoll 2013; Reichow and Volkmar 2010).

Following separate reviews of the research literature, Reichow and Volkmar (2010) and Walton and Ingersoll (2013) identified behavioral interventions as those with the most empirical support for teaching social skills to individuals with ASD, including adolescents with ASD-ID. Behavioral interventions have been used to teach a diverse pool of social behaviors and are most easily identified by the use of explicit antecedent events, such as instructions, models, or prompts, and differential consequences wherein tangible or social reinforcement is delivered for a correct response and an error correction sequence with positive practice is typically administered following an incorrect response (Odom et al. 2010). As an example, Lee and Sturmey (2006) used priming and modeling as antecedent stimuli that increased the likelihood of adolescents with ASD responding to the question “What do you like to do?” and differential reinforcement to teach adolescents to vary their response to the question.

Despite some evidence of behavioral interventions for teaching social skills to adolescents with ASD-ID, it is a relatively small literature base and the feasibility of

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replication across diverse service delivery settings is unknown. In almost all published reports, social interactions involve adults as a social partner (e.g., McDonald and Hemmes 2003) with limited evidence of social interaction with similarly aged peers. Further, instruction is predominately delivered using a one-to-one instructor to student ratio, which is often not feasible in many public school settings (Kasari and Smith 2013) where the majority of adolescents with ASD-ID receive educational programming.

Social skills groups are a popular instructional arrangement for individuals with ASD whose intellectual functioning falls within the average range (Reichow and Volkmar 2010); though minimally demonstrated in the extant literature, social skills groups could be administered within the framework of intensive behavioral interventions for adolescents with ASD-ID. This approach brings together a group of individuals with ASD who meet one or more times per week to learn and practice explicit social behaviors with one another and facilitators (e.g., Dotson et al. 2010). Group arrangements with a single instructor may accommodate as many as five individuals with ASD, which is a more feasible design than the aforementioned one-to-one approach for school settings.

Although most of the social skills group models reported in the literature include children below age 12, Laugeson et al. (2012) described a social skills procedure for adolescents with ASD without co-occurring intellectual disability. The selected skills were pre-determined based on common social deficits for adolescents with ASD and instruction progressed through novel skills each week over 14 weeks. The 90-min sessions involved a review of the previous week, didactic instruction, role play demonstration by facilitators, and a behavioral rehearsal for participants. A concurrent parent group was also administered as part of the protocol so that parents could support adolescent participants in completing homework assignments and generalizing social skills. Outcomes indicated improved social functioning based on ratings by parents and teachers on standardized assessments of social skills, which offers some support of the social skills group format for adolescents with ASD. However, researchers did not directly assess participant's social behavior (e.g., observed social interaction), thereby limiting conclusions about the efficacy of the group procedure for teaching the skills it purports to teach.

Translating the common social skills group model exemplified by Laugeson et al. (2012) to adolescents with ASD-ID requires careful consideration, and might be enhanced by incorporating components of behavioral interventions such as direct measurement of target behaviors with systematic administration of antecedents and consequences associated with those behaviors. Individuals with

ASD-ID have more intensive learning needs than individuals with ASD only (Walton and Ingersoll 2013), thereby requiring frequent (e.g., daily) instruction with many opportunities to practice explicit social skills (e.g., Lee and Sturmey 2006). Importantly, many behavioral interventions use a mastery model of instruction whereby participants must meet a pre-determined level of responding prior to progressing to learning new skills (Reichow and Volkmar 2010). A mastery model may address the same skills for several sessions and necessitates flexibility in the instructional sequence.

Two examples of a mastery model of social skills group instruction were identified in our review of the literature, both were administered outside the school setting (Dotson et al. 2010; Plavnick et al. 2013). Dotson et al. (2010) taught four adolescents with ASD to engage in conversations, give positive feedback, and answer open-ended questions. The requirement to demonstrate mastery of one skill prior to progressing to training on a subsequent skill was built into the single case experimental research design. And although the requirement to meet a specific criterion before advancing to novel skills reduced the overall number of skills individuals were exposed to compared to other social skills group models (e.g., Laugeson et al. 2012), the approach increased the likelihood participants would learn to perform the targeted skills. Four of the five participants mastered all skills and the fifth mastered two of three skills. Three of the five adolescents maintained the skills several months following the termination of training and all demonstrated modest levels of generalization when probed in more natural environments. Similar to most social skills group research with individuals with ASD, the descriptions of participants suggested a milder form of the disorder (i.e., no intellectual disability), though explicit information about intellectual functioning was not included.

Plavnick et al. (2013) also employed a mastery model of instruction when administering a procedure called video-based group instruction (VGI) to four adolescents with ASD and mild to moderate intellectual disabilities. A single-case multiple probe design across behaviors allowed for a rigorous demonstration of effect with each participant. The social skills group relied heavily upon video models to teach five skills to participants over a 10-week intervention. The video models were shown to participants on a laptop or tablet computer and consisted of pre-recorded adolescent and young adult models performing the targeted behaviors during common social interaction opportunities (e.g., asking peers to join them while watching movies or playing games). After observing the videos, participants in the group were then provided with an opportunity to perform the modeled behaviors with one another or facilitators. Direct observation of participants during performance opportunities revealed rapid acquisition and maintenance of

all skills as videos were faded, thereby demonstrating a functional relation between video modeling within a group format and the acquisition of complex social skills by multiple adolescents with ASD-ID at the same time.

As a method of instruction, video modeling has promise specifically for adolescents with ASD-ID as it can reduce the overall amount of language an instructor needs to employ, which is an important consideration for teaching individuals within this sub-group (Walton and Ingersoll 2013). For example, many researchers have found that video modeling facilitates rapid acquisition of skills without the use of additional prompting or vocal instruction (D'Ateno et al. 2003; MacDonald et al. 2009). Video modeling provides a repetitive approach to instruction and the ability to carefully construct and depict the target behaviors in context. A series of videos for a specific behavior can be carefully constructed to support generalization by depicting various forms of the targeted skill across a variety of contexts (e.g., Haring et al. 1987). In addition, preferred consequences can be embedded into the video with similar consequences available to participants contingent on performance of a matching response. Such an approach can aid acquisition of the skill being taught at a particular time and might also bring imitative behavior under stimulus control of subsequent videos (Plavnick et al. 2013).

A limitation of all the social skills research described herein, and the vast majority reported in the extant literature, is that the specialized location of instruction (e.g., clinics, University centers) deviates from the public school setting in which most adolescents with ASD-ID receive instructional services. Despite limited research, the practicality of a school environment offers a number of potential advantages for conducting social skills groups with adolescents with ASD-ID. First, students attend school 5 days a week for the majority of the calendar year, thus creating the potential for a high intensity social skills training program. Second, training would occur in the same general environment where many of the participants will use the prescribed skills. Finally, instructors and group members are readily available, which minimizes the challenges of bringing participants together after school or on weekends and allows individuals with ASD to interact with peers as opposed to only adults. Plavnick et al. (2013) hypothesized that public high school settings might be the ideal location for VGI, though the extent to which the procedures and results can be replicated in a public school with adolescents with ASD-ID requires experimental analysis.

The purpose of the present investigation was to systematically replicate a previous investigation of VGI (Plavnick et al. 2013) by extending the intervention to a public school setting for students with ASD-ID. A second

purpose was to assess generalization of targeted social skills to novel settings and to evaluate long-term maintenance of acquired social skills. Our specific research questions were: (1) Does video-based group instruction lead to improved levels of targeted social skills among adolescents with ASD-ID when administered in a public school setting by district personnel? (2) Are skills learned during video-based group instruction maintained over time? (3) Do skills learned during video-based group instruction generalize to a novel setting?

Method

Participants

After receiving approval from the University Institutional Review Board, researchers recruited a local high school to participate, described the study to special education teachers in the school and asked them to refer adolescent students with ASD-ID to participate in the research study. Four adolescents with ASD-ID were referred and all were included. Teachers selected participants based on similar perceived levels of social interaction prior to the research study. A teacher with a Master's degree in Special Education with an endorsement in ASD was recruited to participate as the VGI facilitator, and was the only adult directly involved in implementation of the intervention. The first author provided training and coaching to the facilitator to implement VGI with fidelity. Initial training involved two half-day sessions consisting of brief didactic training, viewing video recordings of previous VGI sessions, practicing collecting data from video, and role playing VGI implementation. Ongoing coaching was provided to the facilitator during the semester preceding the present study, when the facilitator implemented VGI with a different group of students. Coaching consisted of direct observation by the first author and performance feedback based on items implemented accurately on the VGI implementation checklist (available from first author). During the preceding semester, the facilitator implemented VGI with over 80 % fidelity after coaching had been removed.

Adolescent participants met the following inclusion criteria: (a) prior diagnosis of autistic disorder based on *Diagnostic and Statistical Manual—Fourth Edition* criteria and from a licensed psychologist or psychiatrist outside of the context of the research study; (b) confirmation of autism using the Autism Diagnostic Observation Schedule—Second Edition (ADOS-2; Lord et al. 2012); (c) a standard score below 70 on the Wechsler Abbreviated Scale of Intelligence®—Second Edition (WASI-II; Wechsler 2011); and (d) demonstrated the ability to vocally request or comment, attend to a computer screen, and follow one-step

directions during a screening prior to the investigation. All participants received the majority of their academic instruction in a self-contained special education “center-based program” designed to prepare students for a certificate of completion rather than a high school diploma.

Zena was a 15 year, 2 month old White female, who had standard scores of 56 on the WASI-II and 51 on the *Peabody Picture Vocabulary Test—Fourth Edition* (PPVT-IV; Dunn and Dunn 2007). She independently followed written rules and directions, but required prompts to attend to others, respond to instructions, answer simple questions, and retell basic information about past events. Zena responded to adult models and followed directions conveyed by visual supports (e.g., photographic prompts). She initiated interactions with adults, but rarely with peers. Zena engaged in problem behavior in the form of minor self-injury, crying, and yelling. Problem behaviors typically ceased when she was provided an opportunity to color or draw.

Charlie was a 14 year, 5 month old White male, with standard scores of 53 on the WASI-II and 59 on the PPVT-IV. He initiated interactions with peers when vocally prompted by adults and orally responded to peers or adults when prompted with pictures or written scripts. Teachers indicated that Charlie showed a preference for certain television commercials and the amount of time he engaged with others appeared to increase when a conversational partner referred to familiar television commercials. He followed one-step directions and completed basic tasks such as putting materials away. Charlie engaged in several repetitive behaviors including pulling at the bottom of his shirt, clapping his hands loudly, and emitting brief though loud vocalizations (e.g., shouting out during quiet work periods).

Randy was a 14 year, 6 month old Black male, and completed only the Matrix Reasoning subtest of the WASI-II due to severe language deficits; he had standard scores of 64 on the Matrix Reasoning subtest and 23 on the PPVT-IV. He required frequent redirection and prompting to attend to instructional or social stimuli and complete assigned tasks. Randy spoke minimally, and when he did, his volume was very low and he was difficult to hear. Randy’s teachers noted that he demonstrated a preference for music with gross motor activities (e.g., marching or dancing) and appeared to engage with others for longer periods of time when participating in these activities. He also required prompting to initiate vocal requests for preferred items and activities. Overall, Randy engaged minimally with adults and peers.

Adam was a 17 year, 4 month old Black male, who engaged minimally with the assessor during testing, which led to a standard score of 20 on the WASI-II matrix reasoning subtest and 20 on the PPVT-IV. He emitted

primarily single words to communicate with others, but could echo four- to five-word utterances to request highly preferred items (e.g., “I want a cookie”). Based on teacher report, Adam demonstrated a preference for tasks related to food preparation and also for coloring or drawing; he was most likely to remain engaged with others when participating in these activities. Adam followed one-step directions when reinforcement was signaled (i.e., educator showed him an edible item prior or simultaneous to instruction) or when he was prompted, but did not do so without these supports. Adam interacted minimally with peers and engaged in several repetitive behaviors including waving his hands and rocking his head from side to side.

Setting

The training setting was a 10 m × 12 m self-contained classroom for individuals with ASD. Two rectangular tables were placed parallel to one another in the center of the room; participants sat with the facilitator in chairs around one of the tables, with the second table used as a location for dyadic or group social interactions (as in Plavnick et al. 2013). The group facilitator and adolescent participants were the only individuals in the classroom on a daily basis. A paraprofessional, who video recorded some VGI sessions, and researchers were periodically in the classroom, but neither administered instruction to adolescents.

The generalization setting was a 20 m × 22 m student lounge area and contained four round tables, each four feet in diameter, with four to five chairs placed around the table. Students in the ASD program were often allowed to take breaks in the lounge area during the school day. Although several adolescents could regularly be observed in the lounge at the same time, there were almost no independent peer-directed interactions. A kitchen space and seating area with couches and chairs were also in the room, though not used as part of generalization probes. In addition to the adolescents and facilitator, other students and educational staff entered and exited the room on occasion, but did not participate in generalization sessions.

Materials

An Apple iPad was used to store and display video clips during VGI sessions. A Sony Camcorder (model-HDR-XR160) secured to a tripod was used for filming video clips used in VGI. Several preferred items (i.e., games, toys, edibles) were used during the VGI sessions and were also embedded within the video clips. Data were collected using pencil and paper.

As in Plavnick et al. (2013), three 20- to 30-s video clips were created to depict variations of each target behavior. Male and female models between 18 and 19 years of age

were depicted in the videos. A total of 18 videos were used to teach six behaviors during the study; three versions of each behavior were developed with variations to the models, stimuli, and language across videos to promote variability in responding. In addition, each video included relevant antecedents, the target behavior, and naturally occurring consequences, which were putative tangible reinforcers (e.g., accessing missing item when asking for materials) or generalized reinforcers such as praise or extended social interaction. The description of antecedents and consequences associated with each target behavior in Table 1 provides an example of the type of event also depicted within the videos.

Dependent Measures

Two target behaviors for each of the following social domains were measured for each participant: (1) behaviors that produce access to preferred stimuli mediated by a peer, (2) behaviors that indicate social attending to others, and

(3) behaviors that produce social attention mediated by a peer. Domain one behaviors included joining an activity and requesting materials. Domain two behaviors were offering assistance to others and asking for information about others. Behaviors targeted for domain three were showing something to a peer and directing an open-ended comment toward a peer. All target behaviors are explicitly defined below with antecedents, consequences, and examples depicted in Table 1. Although vocal statements and requests were required for three of the four participants, partial vocal or gestural responses to gain peer attention were accepted for Adam beginning with the eighth intervention session of domain one and based on language deficits that limited his vocal responding.

Observers recorded the occurrence or nonoccurrence of targeted social behaviors following programmed antecedents during probe and intervention sessions. The total correct responses for a domain were divided by the total response opportunities for that domain and multiplied by 100 to obtain a percentage. During generalization probes,

Table 1 Dependent measures with programmed antecedents, consequences, and examples

Target behaviors	Definition	Antecedents	Consequence	Example
<i>Domain 1</i>				
Joining activity	Approaches peers engaged in activity, obtains attention, 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	Able to join peers in preferred activity	Target student approaches peers involved in game. Says, “Hi guys! Can I play with you?”
Requesting materials	Obtains peer attention and asks for specific item that peer has	Has one part of two-part activity. In close proximity to one or more peers who have other part	Obtains access to item necessary to complete activity	Target student has color change marker, but not the correct book. Asks peer for page from book
<i>Domain 2</i>				
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!”)	Facilitator thanks student for helping	Target student says, “I can help you,” and then engages in helping adult (e.g., getting towels to clean up mess)
Asking for information	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 (“Joey did something exciting today.”)	Peer answers target student’s question	Target student says, “Hey Joey, what did you do before group today?”
<i>Domain 3</i>				
Showing items to others	Looks toward and obtains peer’s attention, points toward or holds up item, and emits vocalization related to item to peer	Students completing activities at same table. Facilitator says to target student “I bet your friends would like that”	Peer responds to target student’s initiation (e.g., “cool”)	Target student says “Check out my drawing.” Peer says or is prompted to say “That is neat.”
Commenting	Obtains attention of peer and emits comment related to present activity or future/past event	Students involved in common task. Facilitator quietly says to target student “I bet your friends want to know what you did yesterday?”	Peer’s respond to target student’s initiation	Target student says “I got a new game last night.” Peer says or is prompted to say “Cool. What game?”

the teacher or research assistant recorded the frequency of each behavior occurring within a 10-min session.

All observers were trained by the first author to collect data during VGI sessions and had to demonstrate 90 % reliability prior to independently collecting data during VGI sessions. The group facilitator was the primary observer. A doctoral student collected reliability data across 53 % of probe sessions and 45 % of intervention sessions. 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. Table 2 depicts IOA for each participant across all conditions and targeted domains.

Domain 1: Accessing Preferred Stimuli

Joining an activity in progress was defined as: (a) approaching one or more peers involved in an activity, (b) emitting an attention getting vocalization, such as “hey there” or “hi [peer name]” or gesture in Adam’s case (e.g., lightly tapping the peer’s arm or hand), (c) asking to join the peer(s) in the activity, and (d) joining the peer(s) after receiving an affirmative response. Requesting materials from a peer was defined as gesturing toward a preferred item while asking a peer(s) to give him the preferred item. For example, if participants were completing a color by number assignment, one would ask the other for a specific colored pencil. The behaviors in this domain were paired together and taught first because both led to a preferred consequence; it was hypothesized that the preferred outcome might train students to imitate video models more generally or possibly increase their overall interest in the VGI sessions in a manner similar to training young children with ASD to request preferred items during early language training (Sundberg and Michael 2001).

Domain 2: Demonstrating Social Awareness

Helping others was defined as vocalizing an offer to help and engaging in a behavior similar to that of an adult who was engaging in physical, vocal, and affective behavior

that signaled the need for help (see Reeve et al. 2007 for examples of help scenarios). Asking for information about others was defined as getting the attention of a peer when involved in an activity and asking a specific question about that person. The skills in domain two were paired together and taught second because they are social behaviors that a broader community typically begins teaching at an early age and consistently encourages children to perform. As such, it was hypothesized that the behaviors may be acquired more easily than those targeted in domain three.

Domain 3: Obtaining Social Attention

Showing things to others was defined as (a) orienting toward a peer, (b) gesturing, gently tapping, or vocalizing to obtain the peer’s attention, and (c) pointing toward, holding up, or making a statement about the item being shown (e.g., “Look at what I built!”). Commenting was defined as getting the attention of a peer when involved in an activity and making an open-ended comment related to the present activity (e.g., “this reminds me of a game I play at home”) or to a future or past event. These behaviors were paired together and taught last because our experience suggested they are more difficult social skills to teach individuals with ASD.

Experimental Design

A multiple probe design (Gast and Ledford 2010) across social skills domains (i.e., paired behaviors) was used to assess the effects of VGI on social behavior of participants. All behaviors were probed under baseline conditions and VGI was then applied to the target behaviors within the initial domain until all participants demonstrated a clear change in level of responding. At that time, all behaviors were again probed under baseline conditions. Probing all behaviors after a targeted behavior reaches criterion serves two purposes. First, it allows for a test of the extent to which the naturally occurring antecedent stimuli (e.g., peer in possession of preferred activity) evoke the target behavior without displaying the video model. Second, the probe allows for confirmation that non-targeted behaviors

Table 2 Inter-observer agreement (mean and range) across participants, conditions, and domains

	Domain 1		Domain 2		Domain 3	
	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention
Zena	97 % (83–100 %)	97 % (83–100 %)	89 % (50–100 %)	83 % (66–100 %)	100 %	100 %
Charlie	97 % (83–100 %)	91 % (66–100 %)	100 %	94 % (66–100 %)	100 %	100 %
Randy	100 %	97 % (83–100 %)	86 % (50–100 %)	94 % (83–100 %)	97 % (83–100 %)	91 % (83–100 %)
Adam	97 % (83–100 %)	93 % (83–100 %)	91 % (66–100 %)	94 % (83–100 %)	100 %	100 %

occur at similar levels to the original baseline. Alternating conditions of intervention and baseline probes were conducted in this manner until participants received VGI for all target behaviors.

Setting generalization was assessed by measuring the frequency with which participants performed the behaviors without first seeing the video in an alternative environment (i.e., lounge area). These sessions occurred on the same days as the initial probes mentioned above, which allowed for an experimental analysis of setting generalization. Maintenance of social responding was assessed for three of the participants by probing behaviors under baseline conditions immediately following the application of VGI to the third domain and for two of the participants at 4 months post-intervention.

Procedures

Pre-assessment

A teacher completed the Autism Social Skills Profile (ASSP; Bellini 2006) for each participant prior to the delivery of VGI. The ASSP includes a series of questions about social behaviors or interactions that a rater answers on a 4-point rating scale. Teacher ratings indicated participants never or infrequently emitted the behaviors targeted for the present study. Informal and brief interviews were conducted with educators to confirm the results of the ASSP and to identify behaviors that may interfere with peer social interactions. Teachers were also asked to complete a preference survey in order to identify potential reinforcers to embed within the instructional procedures during group sessions.

Probe Sessions

Probe sessions were administered prior to any instruction and after participants acquired each of the targeted behaviors within a domain. Probe sessions were conducted to assess the extent to which participants performed the targeted skills without viewing the video models or receiving feedback from the facilitator. Three pre-intervention probe sessions were conducted and included all participants except Charlie, who was absent during the final session. Additional probe sessions were conducted following the acquisition of target behavior for participants during the video-based group instruction condition (see below).

Procedures during probe sessions were similar to those described in Plavnick et al. (2013). Activities involved (1) teaching or reviewing basic rules for group interaction and (2) assessing targeted social skills; the latter of which was the focus of the present study. To begin a probe session, the facilitator introduced general rules for social interaction

(e.g., look at others when talking), which were not the same as or similar to the target behaviors described above, and provided numerous opportunities for each participant to demonstrate rule-following behavior during a 5-min introductory activity. A token economy system was used to reinforce rule following behavior across all social skills group sessions.

The rule review was followed by an assessment of targeted social skills. To assess for targeted skills, the facilitator contrived three opportunities (i.e., trials) for each participant to emit each of the identified behaviors with peers, or with the facilitator when assessing helping others. Table 1 outlines the range of antecedent stimuli associated with contriving trials for each behavior. If participants performed a target response within 10 s of the contrived antecedents during probe sessions, they experienced naturally occurring consequences that corresponded to the various behaviors (see Table 1). If a participant did not perform the target response within 10 s, then social interactions were kept to a minimum, and the facilitator redirected students away from interaction with peers. Following an opportunity to perform the response and receive the corresponding consequence for one participant, a trial was contrived for another participant. Trials were presented to participants in random order and the sequence repeated until all participants had at least three opportunities to engage in all targeted behaviors. No videos were shown during probe sessions and the facilitator delivered no vocal feedback or prompts for correct or incorrect responses.

Video-Based Group Instruction

The VGI sessions were conducted four or 5 days per week for 40 min each session. A single VGI session included three components: (1) a 5- to 7-min rule review, (2) 25–30 min of direct skill instruction using video modeling, and (3) a final activity designed to provide opportunities for social interaction with peers under more naturally occurring conditions than those contrived during direct skill instruction (e.g., playing a game, constructing a puzzle). The direct skill instruction with video modeling is described in detail as responding during this component was the focus of the present study.

Two target social skills were taught during the direct skill instruction component of each VGI session. Each participant received three to four trials to perform each skill. To begin direct skill instruction, the facilitator instructed all participants to sit around the same table, held an iPad where all could view the screen, and instructed participants to “watch the video because I want you to do and say what the people in the video do and say when you talk to your friends.” The facilitator showed a video of

typical adolescents engaging in the target behavior. Each participant then had an opportunity to perform the target behavior as described during probe conditions.

If a participant performed the target response, he or she was able to access the corresponding consequence (see Table 1). If a participant did not engage in the correct behavior, the facilitator approached the participant before the corresponding consequence could occur and provided specific corrective feedback (e.g., “next time, be sure to get your friends attention before asking for the cup”). Following an incorrect response and feedback, the facilitator told the participant to sit down in his or her original chair and wait for his or her peers to finish. All participants had an opportunity to perform the target response and then the sequence was repeated until each participant experienced three or four learning opportunities for each behavior in the targeted social skills pairing. Order of participant performance rotated across trials so that a different participant had an opportunity to perform the first trial following a video viewing. In addition, the facilitator showed a different video exemplar for a target behavior across trials so that participants could observe varied examples of how a particular skill could be performed.

The criterion for transitioning from a VGI phase to a probe phase was for all participants to demonstrate 80 % accuracy across two training sessions. However, after observing that this criterion extended VGI phases on account of Adam only, an adjustment was made to administer VGI for domains two and three until all participants except Adam met the mastery criterion. Adam continued to participate in sessions and received support to acquire the rules for social interaction. Instruction was also individualized for Adam by providing prompts to initiate with peers and accepting gestures as alternatives to the originally targeted vocalizations.

Maintenance and Generalization

Maintenance probe sessions were identical to pre-intervention probe sessions and were conducted 2 weeks following the final intervention sessions for Zena, Charlie, and Randy, and after 4 months of no intervention for Zena and Charlie. Generalization probe sessions were administered in the lounge area immediately following each probe session across the duration of the research study and were designed to be very similar to the final activity of a VGI session. Generalization probe sessions lasted 10 min, and involved the facilitator creating an environment in which participants would have an opportunity to perform all of the behaviors taught during the VGI sessions. The facilitator placed preferred items used during VGI sessions (e.g., puzzles, games) on the round tables where students spent their time within the lounge area and rotated the

items every 3 min. Students were instructed to sit together at one of the round tables and interact with the items. Specific trials were not conducted during generalization probes in order to minimize facilitator involvement; instead, the facilitator counted any instance of each of the targeted behaviors during the 10 min period. No prompts or feedback were provided to participants during generalization probes.

Procedural Integrity

The researchers collected procedural integrity data for 18 % of VGI sessions to assess accuracy of implementation and provide ongoing evaluative feedback to the teacher. Feedback was delivered after a VGI session and involved observation and discussion of ratings on a procedural integrity checklist created by the researchers. The checklist contained 49 items divided into sections including teacher preparedness for the group, the components of a VGI session, instructional approach, and behavior management. Each item was scored as “never,” “sometimes” or “always” implemented correctly. By including all three items as opposed to only a dichotomous coding system, the researchers could score items implemented correctly if they received a rating of “always” while including a rating that could indicate to the teacher when she was doing something correctly some of the time, but not all the time. To derive a procedural integrity score, the researchers divided the percentage of items “always” implemented correctly by the total number of items (i.e., 49) and multiplied by 100 to obtain a percentage of procedural integrity for a session. If procedural integrity dropped below 80 %, the researchers provided within-session coaching until accuracy of implementation increased to above 80 %. Mean procedural integrity was 81 % (range, 75–86 %) with two instances of sessions below 80 % and subsequent within-session coaching by researchers occurring during the study.

Social Validity

Semi-structured interviews consisting of questions focused on goals of the intervention, acceptability and feasibility of the procedures, and importance of the outcomes (Wolf 1978) were administered to the facilitator of VGI, a second ASD teacher in the building who was familiar with the adolescent participants, and two paraprofessionals who worked with the participants on a daily basis. Table 3 provides an example of the questions administered to the facilitator. Slight modifications were made to these questions for other professionals who did not directly administer the intervention but either observed sessions or had frequent interactions with the adolescent participants. The goal of the interviews was to identify explicit and detailed

Table 3 Interview questions for social validity assessment

Social validity construct	Interview questions
Adequacy of the goals	Would you consider the target behaviors to be important? Are there other behaviors you think would be beneficial to teach? Were the selected target behaviors an area of concern for the participants prior to VGI?
Acceptability of procedures	How do you feel about the procedures used in VGI? Describe how easy or hard it was to implement the intervention. Which aspects of the intervention do you like least/most and why? Which aspects are most difficult to implement? What changes would you make to improve the intervention? Have any of the procedures used as part of VGI been beneficial in other areas of teaching? If so, how? Do you plan on continuing to use the intervention after the study? If no, why not?
Satisfaction with outcomes	Do you think the intervention worked? If so, how well? What changes in behavior did you notice? Did these changes make a difference for students in other settings? Did you notice any changes to student behaviors that were not explicitly taught? Are you satisfied with the outcomes of the intervention? Would you recommend this intervention to other teachers?

VGI video based group instruction

perceptions of the intervention in order to inform procedural revision prior to scaling up the intervention at the same school setting, planned for the following academic year. A research assistant who was not directly involved with implementation of VGI conducted the interviews and transcribed recorded responses to generate themes from the interviews.

Results

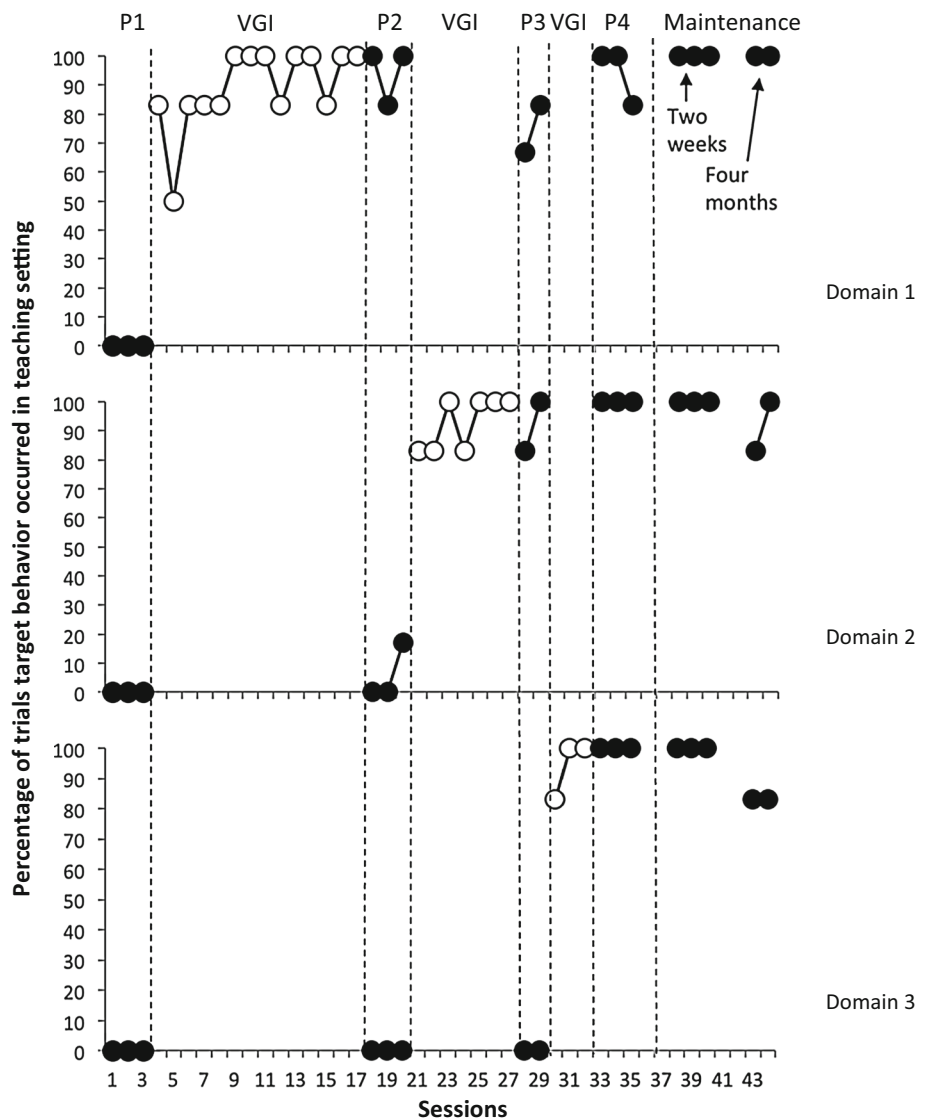
Results of VGI on social behavior for Zena are displayed in Fig. 1. Zena demonstrated no responding across all behavioral domains during the initial probe. Zena immediately performed the target behaviors when VGI was applied to the first domain with mean responding of 89 % (range, 50–100 %). During the second probe, Zena demonstrated a high level of responding for the first domain ($M = 94 %$) and very low responding for the second ($M = 5 %$) and third ($M = 0 %$) pairs. When VGI was applied to the second domain, Zena's mean responding increased to 93 % (range, 83–100 %). Mean responding for the first ($M = 75 %$) and second ($M = 91 %$) domains remained high during the third probe while the third, and still untaught, domain remained at zero. Responding increased immediately upon implementation of VGI to the third domain with mean responding of 94 % (range, 83–100 %). A series of probes was conducted following targeted instruction of all domains as well as 2 weeks post-intervention and Zena's mean responding remained very high ($M = 97 %$). A final maintenance probe was

conducted 4 months after the termination of VGI and Zena demonstrated a mean of 100, 91, and 83 % for domains one, two, and three, respectively.

Results of VGI on social behavior for Charlie are displayed in Fig. 2. Responding for all behaviors was 0 % during the initial probes and increased to a mean of 86 % (range, 33–100 %) for the first domain when VGI was applied. Responding remained at 100 % during post-intervention probes, with non-targeted skills in domains two and three at 13 % (range, 0–17 %) and 8 % (range, 0–17 %), respectively. When VGI was applied to domain two, mean responding increased to 94 % (range, 83–100 %). Responding during the following probe condition was 100 % for both domain one and two, yet remained low for the untreated domain three ($M = 17 %$). Though a slight increase in the third domain was observed during probe three, a large and immediate change was observed following the application of VGI to the third domain ($M = 94 %$) and there was no overlap with data collected during probe sessions. Responding for all behaviors remained at 100 % during post-intervention probes. At 4 months post-intervention, Charlie performed the target behaviors with 100, 74, and 91 % accuracy for domains one, two, and three, respectively.

Results of VGI on targeted social behavior for Randy are displayed in Fig. 3. Randy showed a gradual increase in responding each time the intervention was applied to a domain. During the initial probe, responding was 0 % for all behaviors. Responding for domain one increased to a mean of 68 % (range, 0–100 %) when VGI was applied. Responding for domain one increased ($M = 96 %$) during

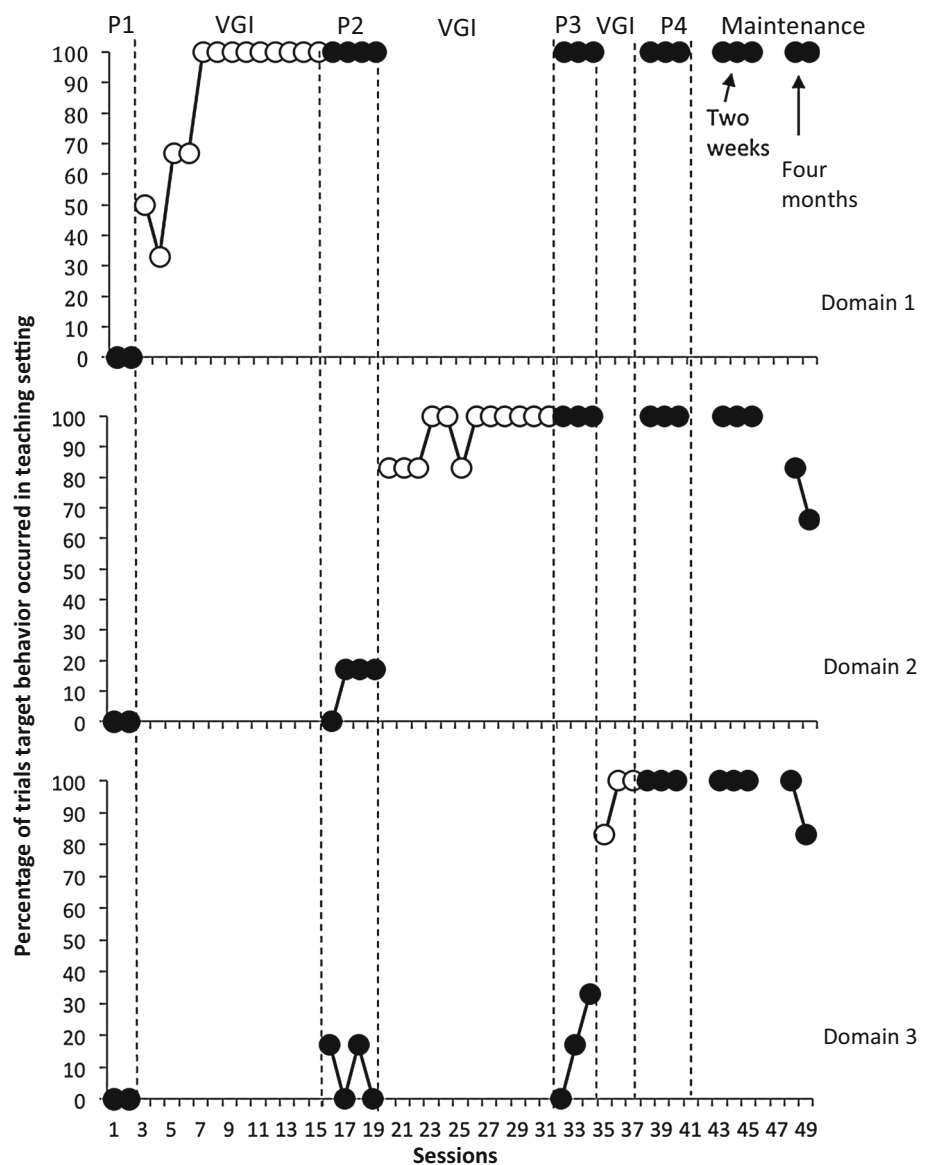
Fig. 1 Percentage of trials Zena performed accurate behaviors during probe (closed circles) and training (open circles) sessions across social domains. Maintenance depicts post-intervention probes of all behaviors occurring at 2 weeks and 4 months post intervention



the following probe condition while responding for domains two ($M = 4\%$) and three ($M = 4\%$) was again low. VGI was then applied to domain two and performance for those behaviors increased to a mean of 57% (range, 0–100%). During the following probe condition, responding for domain one ($M = 100\%$) and two ($M = 89\%$) remained high with responding for the untreated third domain still low ($M = 6\%$). Responding quickly increased when VGI was applied to the third domain with a mean of 61% (range, 17–83%). During post-intervention probes, Randy demonstrated means of 100, 72, and 83% accuracy for domains one, two, and three, respectively. Mean responding during the maintenance probes 2 weeks later was 100% for domain one and 94% for domains two and three. Randy changed schools over the summer and was not available for a 4-month follow-up probe.

Results of VGI on targeted social behavior for Adam are displayed in Fig. 4. Adam engaged in zero-rate responding for all domains during the initial probe. He demonstrated a gradual increase in responding when VGI was applied to domain one with a mean of 46% (range, 0–100%) and did meet mastery criteria for these behaviors. Responding remained high for domain one during the subsequent probe condition when VGI was removed ($M = 94\%$) and was still very low for domains two ($M = 4\%$) and three ($M = 4\%$). Responding was inconsistent and relatively low when VGI was applied to domain two, though the mean of 21% (range, 0–67%) was higher than probe conditions. The following probe condition revealed high rates of responding for domain one ($M = 83\%$), moderate rates of responding for domain two ($M = 33\%$), and low responding for domain three ($M = 6\%$). When VGI was applied to the third domain, Adam engaged in the target

Fig. 2 Percentage of trials Charlie performed accurate behaviors during probe (*closed circles*) and training (*open circles*) sessions across social domains. Maintenance depicts post-intervention probes of all behaviors occurring at 2 weeks and 4 months post intervention



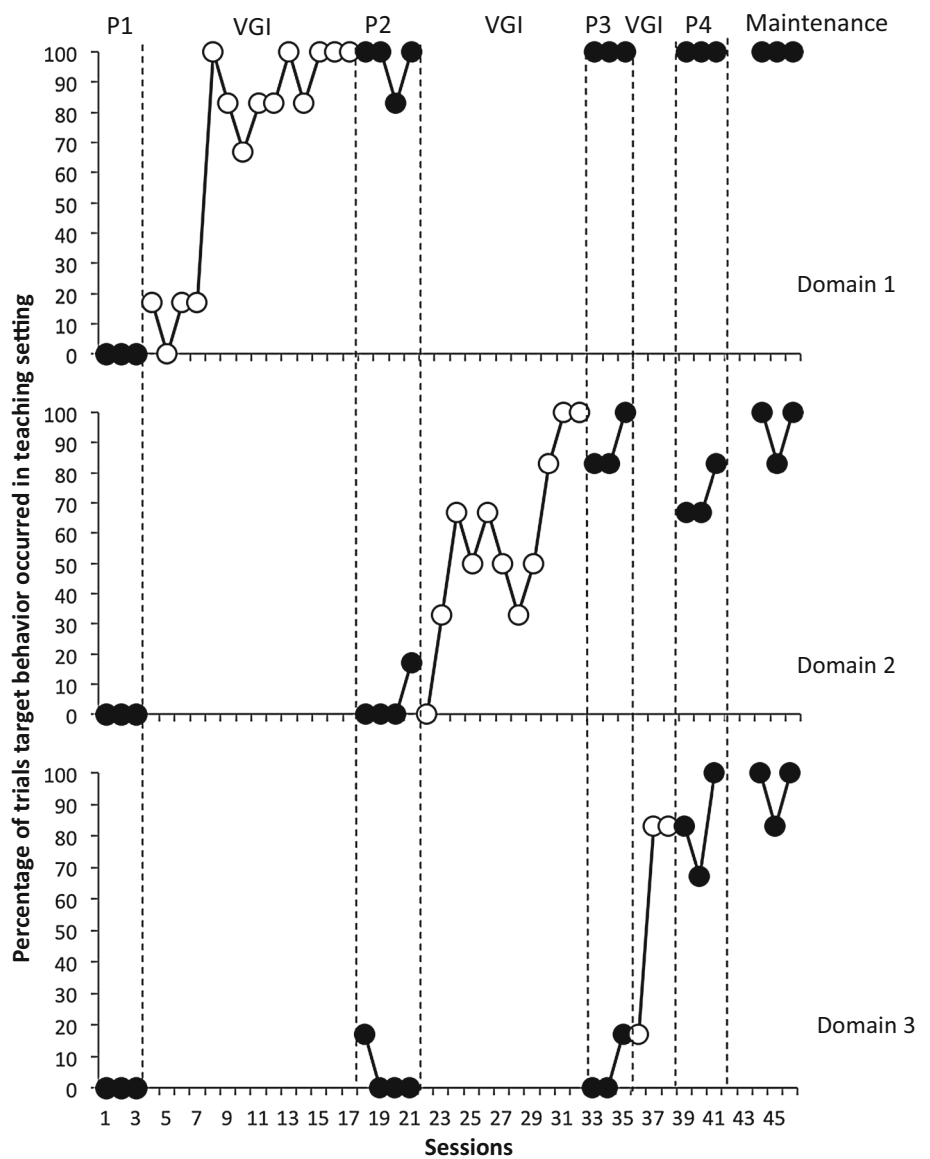
behaviors for 33 % of the opportunities across every session. During the post-intervention probe, Adam performed skills with means of 100, 44, and 22 % accuracy across domains one, two, and three, respectively. Adam was not available for the maintenance sessions that were administered 2 weeks and 4 months after VGI was applied to the final domain.

Results of generalization probes are depicted in Fig. 5. Results of pre-VGI probes show participants engaged in almost no instances of the target behaviors in the generalization setting prior to training with VGI. The lone exception was Charlie emitting a single comment during one generalization probe session. Participants demonstrated minimal generalization in the probes administered immediately after they met acquisition criterion for each of the

social skills domains. In subsequent probes, Zena, Charlie, and Randy demonstrated an increase in performance of target behaviors in the generalization setting for domains one and two. Adam demonstrated generalization of skills taught during domain one, but not domain 2. Only Zena demonstrated generalization of skills taught during domain three, though this was limited to a single instance in the first and third probe sessions for domain three.

Results of the semi-structured interviews indicated that all educators believed the behaviors were important to target, as participants did not demonstrate social interactions with peers in the school prior to involvement in VGI and that the specific behaviors targeted in the study were valuable behaviors to teach the participants. Views on procedures were somewhat mixed, with all informants

Fig. 3 Percentage of trials Randy performed accurate behaviors during probe (*closed circles*) and training (*open circles*) sessions across social domains. Maintenance depicts post-intervention probes of all behaviors occurring 2 weeks post intervention

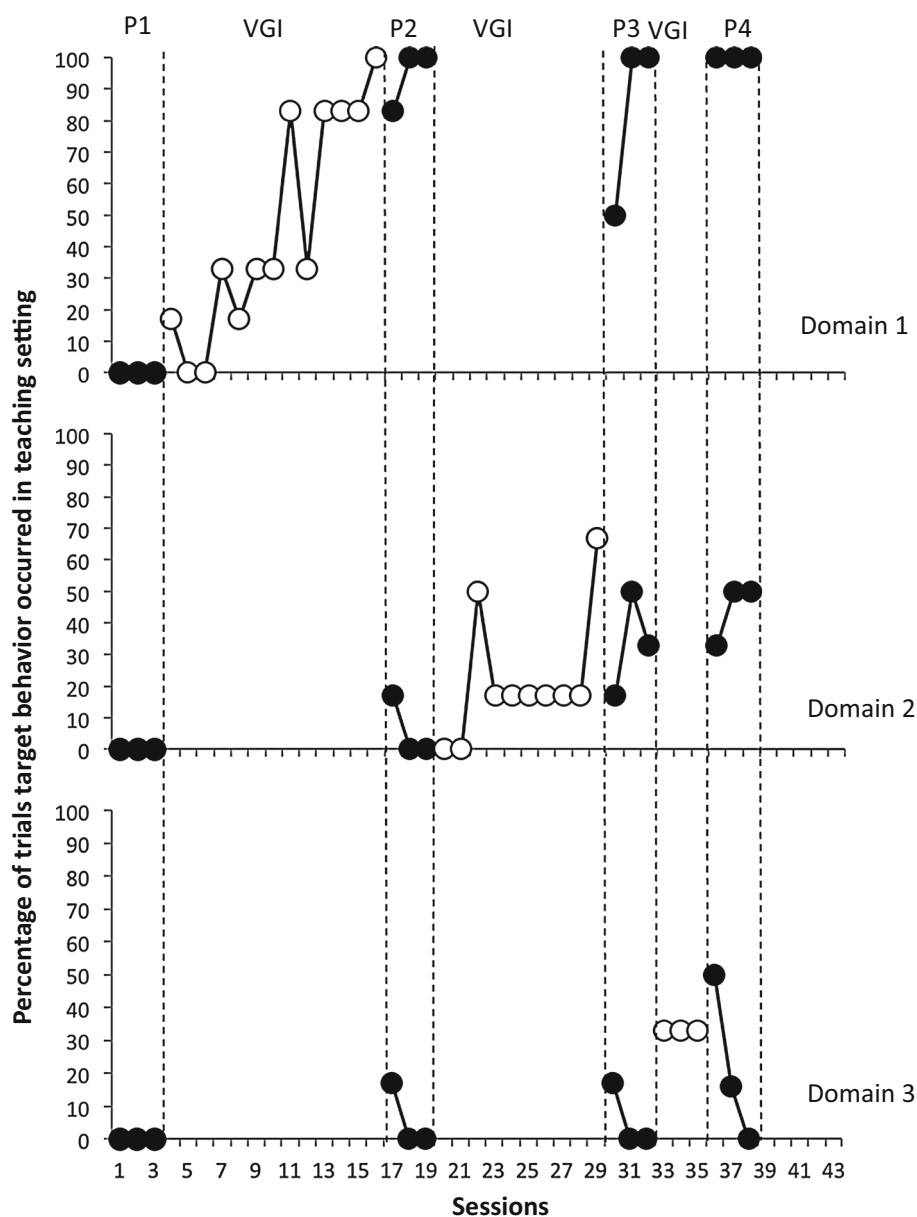


indicating that implementation was somewhat difficult at first, but that the procedures became gradually easier to implement over time. All indicated they would like to see the program continued with minimal procedural modifications during the following academic year. Perceptions of outcomes were also mixed with educators indicating positive results across the board during training sessions and some change in overall social competence for the participants. One additional and important source of data pertaining to social validity was the school’s ongoing use and expansion of the VGI program during the following academic year. With support from building and district administration, the facilitator from the present investigation and two additional teachers elected to implement VGI with their students.

Discussion

Overall results confirm that VGI can be a successful intervention model for adolescents with ASD and moderate intellectual disability (e.g., Zena, Charlie, and Randy) and that the procedures can be implemented within a public school setting. Zena, Charlie, and Randy demonstrated a rapid increase in performance of social skills upon introduction of VGI to each skill domain. These outcomes offer replications of previous research on VGI for teaching social skills to adolescents with ASD-ID (Plavnick et al. 2013). Alternatively, Adam did not reliably acquire targeted skills and his pattern of responding might therefore offer information about the boundary of the functional relation between VGI in its current form and the acquisition

Fig. 4 Percentage of trials Adam performed accurate behaviors during probe (*closed circles*) and training (*open circles*) sessions across social domains



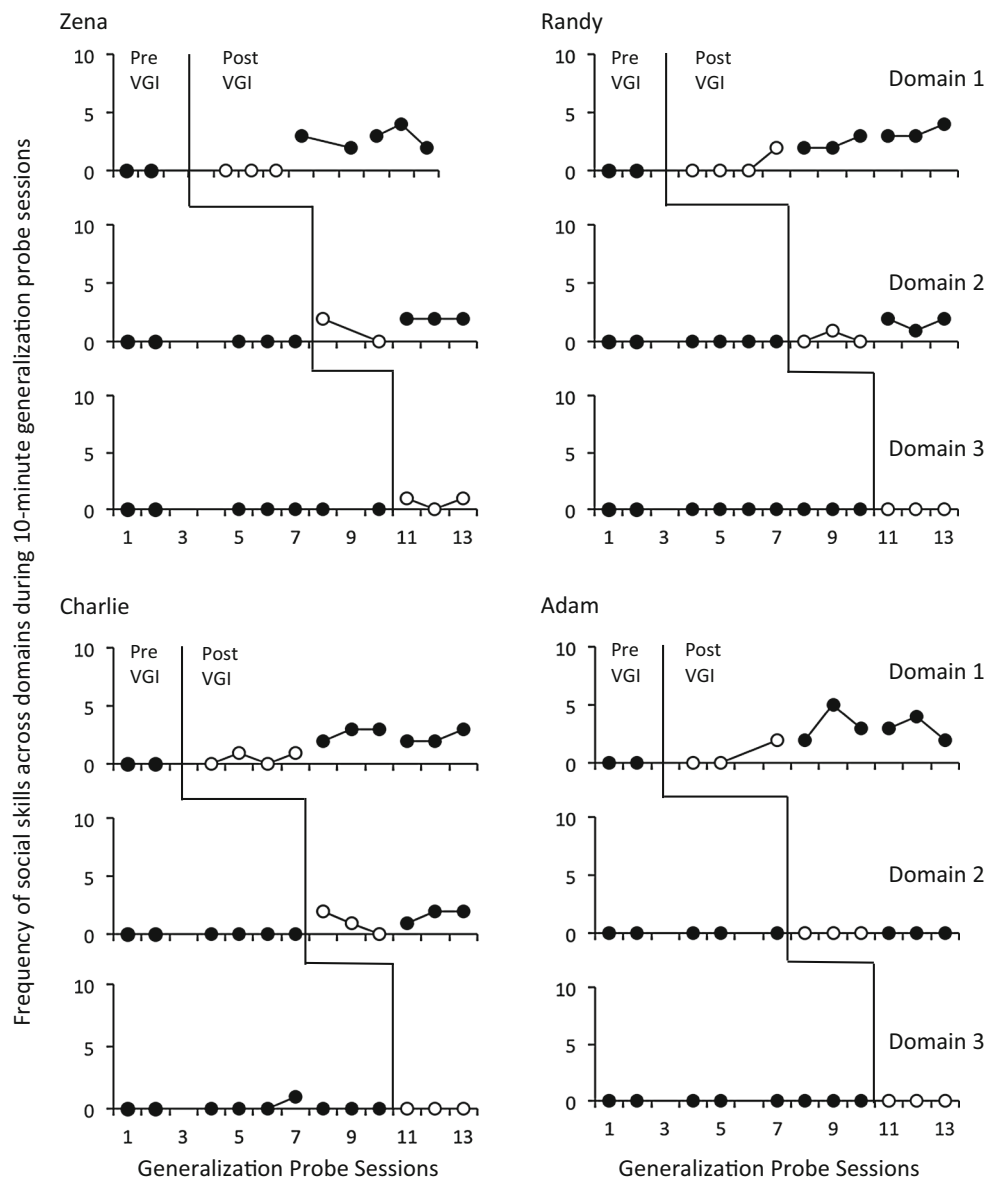
of social behavior. As discussed in detail below, the results speak to the need for modification to VGI procedures for adolescents with ASD and more severe intellectual disability.

Maintenance and generalization results were somewhat mixed. Behaviors that were acquired (i.e., participants met accuracy criterion) were maintained; and the two participants for whom long term maintenance was assessed, Zena and Charlie, continued to meet acquisition criteria across all behaviors 4 months after completion of the social skills group. Participants demonstrated some generalization of skills to a novel setting, though generalized responding was inconsistent and did not emerge in the generalization setting immediately following training for a specific skill.

These results indicate additional supports or procedural modifications are likely needed to reliably facilitate generalization following VGI.

The rapid acquisition of targeted behaviors upon implementation of VGI for three of the four participants was consistent with other applications of video modeling (e.g., D'Ateno et al. 2003; MacDonald et al. 2009). The results extend previous VGI research, and social skills group instruction more broadly, by demonstrating effective administration of a social skills group for individuals with ASD-ID as part of a daily curriculum within a public school setting. This is an important extension as few social skills interventions for adolescents with ASD-ID have been investigated in such settings (Carter et al. 2014) and several

Fig. 5 Frequency of social skills during 10-min generalization probe sessions across domains for all participants. *Open circles* depict series of generalization probes occurring immediately following training to acquisition criterion



researchers have recently emphasized the importance of aligning research-based interventions with realities of public school environments (e.g., schedules, reasonable demands on staff, and remaining consistent with the philosophies of staff and programs) (Kasari and Smith 2013; Walton and Ingersoll 2013). Although preliminary, the present study suggests VGI might possess features that meet the logistical needs of schools and lead to positive outcomes for participants. With minor modifications, VGI could be effective for a wide range of children with ASD-ID. Although anecdotal, evidence to support the feasibility of implementation in the school setting came from the teacher and paraprofessionals who worked with students involved in the intervention, who (a) reported that the procedures were effective and feasible to implement,

(b) continue to use the intervention with their students over 1 year later, and (c) have recommended the intervention to colleagues.

The present study also extended VGI to teach sharing and commenting, two skills that require an individual to initiate an interaction with minimally salient environmental stimuli and the only consequences for which involve social acknowledgement from a peer. Individuals with ASD often demonstrate specific deficits in initiating behaviors and, once learned, may not extend initiations beyond basic requests for preferred items (Kasari and Patterson 2012). In addition, unlike teaching an offer of help, where the discriminative stimulus is a social partner engaging in several behaviors indicating distress, the discriminative stimulus involved in making a comment or showing something to

another adolescent may not be as salient. The outcomes for showing items and commenting therefore suggest VGI might be an effective approach for teaching more complex, or subtle, social interaction skills to adolescents with ASD-ID.

The effects for Adam deviate from those observed for other participants. Adam showed a gradual increase in responding for domain one, but showed minimal gains for social domains two and three. Although Adam appeared to be the most severely affected participant, in terms of intellectual disability, across both the present and previous VGI studies (Plavnick et al. 2013), we assume he was capable of learning from VGI as he was able to acquire, maintain, and generalize the behaviors in domain one, which involved behaviors that lead to immediate preferred consequences. Domains two and three involved behaviors that lead to social interaction with others, which were likely neutral or nonpreferred consequences for Adam.

Adam's pattern of responding offers a potential explanation for how VGI might work and considerations that may be necessary for individuals with more severe intellectual disabilities. We hypothesize that embedding preferred consequences within the video models during domain one, and delivering those same consequences contingent on correct responding, increased the effectiveness of the video model for this domain. However, similar consequences were not included in domains two and three. Instead, participants observed social interaction as a consequence in the video and obtained social attention contingent on correct responding, which likely did not function as a reinforcer for Adam. For students such as Adam, it may be beneficial to initially select only those target behaviors that produce naturally occurring reinforcers and gradually fade in skills that are followed by purely social consequences (e.g., commenting).

The explanation of generalization outcomes may be similar to the pattern of acquisition observed for Adam. Generalization of behaviors in domain one was more reliable than behaviors taught during domains two and three, which might have been a function of the naturally occurring reinforcers (i.e., access to preferred items) obtained following skills in domain one but not for domains two or three. Such an outcome is consistent with the finding that individuals with ASD are more likely to generalize behaviors that lead to naturally occurring reinforcers (Koegel et al. 2009). Another explanation for the outcomes during generalization probes is that participants required multiple opportunities to identify the discriminative stimuli associated with each behavior in the natural environment. The lack of generalization during probes adjacent to training and emergence during subsequent probes offers support for this hypothesis, though the data in the present analysis only allow for speculation and not experimental confirmation of

the mechanism responsible for modest levels of generalization.

Maintenance outcomes showed that Zena, Randy, and Charlie continued performing the skills during post intervention probes conducted 2 weeks following termination of the intervention. In addition, the only participants probed following a summer vacation (Zena and Charlie) showed maintenance of skills up to 4 months after termination of the intervention. These outcomes diverge from previous examinations of social skills instructional programs in the school setting, which showed less remarkable maintenance (Bellini et al. 2007), but are similar to the maintenance findings of Dotson et al. (2010), who also employed a mastery model of instruction. The mastery model, daily instruction, and use of video models as opposed to educator prompts to teach targeted skills might have contributed to the extended maintenance outcomes observed in the present investigation.

There are several limitations of this study that require greater consideration. First, measurement was limited to the social targets only and the results do not allow us to speak to broad gains in social competence, as would be obtained through administration of standardized pre- and post-assessments using a between group design. Broad changes in social functioning are clearly an important goal for social skills group interventions (e.g., Laugeson et al. 2012) and given the dosage and intensity of VGI, it is important to know whether the program leads to such robust outcomes. It will be important for future research to combine direct observation of targeted social skills with standardized measures of social competence to rigorously assess overall social functioning following implementation of VGI.

Second, assessment of generalization was limited to one setting and involved only members of the social skills group; it is not known whether social behavior increased across the school and with other adolescents. Given the relatively modest levels of generalization observed herein, we expect additional intervention components would be necessary to support generalization. Future VGI research should assess generalization across a range of contextual stimuli (e.g., additional environments, social partners, types of activities) and experimentally evaluate components that contribute to improved generalization. Relatedly, there were only two generalization probes during the initial baseline for all of the participants, which is less than the recommendation of three data points in every condition for a single-case experimental design that meets quality standards with reservations (Kratowill et al. 2013). This occurred because of scheduling difficulties in the generalization setting for the present study and will need to be more carefully addressed in future research.

A third limitation is that the generality of the intervention to novel sites may be in question as the facilitator received support and coaching from researchers as she implemented the intervention. The level of support may be impractical in future iterations and would not be part of the intervention if a school district were to adopt and implement the program separate from a research study. Future researchers could therefore assess the amount of support needed for educators to sustain accurate implementation of VGI before the intervention can be widely adopted for use in these settings.

Finally, generalization of behaviors was recorded as an instance of a domain and not as an individual behavior, thereby limiting the extent to which generalization can be fully evaluated. It is possible that certain behaviors generalized and others did not, though the aggregated data do not allow us to go back and extract such information. This is only an issue for the generalization data as the 80 % acquisition criterion ensures participants reliably performed both behaviors in a domain before moving to subsequent domains.

Several additional aspects of VGI warrant future research. The extension of the procedures to behaviors such as sharing and commenting in the present study suggest VGI, and video modeling more specifically, might be effective in teaching social interaction skills often associated with core ASD deficits (e.g., joint attention). However, the absence of generalization of these skills across all participants suggests it is an area in need of future research. Relatedly, we presume that the procedures could be extended to target behaviors (social or otherwise) necessary for specific environments (e.g., vocational settings). Such an extension requires careful planning and experimental analysis, as other behaviors might not fit with the same approach described herein. Future research might also attempt to define specific characteristics of individuals, such as severity of intellectual disability, who may benefit most from VGI. Although all participants were diagnosed with both ASD and ID, not all participants responded the same way to the intervention. Information that helps service providers select optimal students for participation in similar social skills groups would be beneficial.

The current study adapted a social skills training program, VGI, and extended the procedures to a public high school. VGI offers a potentially feasible intervention for teaching social skills to adolescents with ASD-ID. Further, the procedures might promote generalization of trained social skills. To date, very little research has been conducted to examine interventions to teach social skills to this sub-group (Walton and Ingersoll 2013) and even less has assessed feasibility of implementation in school settings. The outcomes of this study suggest that VGI can be beneficial for adolescents with ASD-ID and that the

intervention has potential to be implemented as part of a daily program of instruction within a public school setting.

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