The relative effects of social stories and video modeling toward increasing eye contact of adolescents with autism spectrum disorder

Roderick D. O'Handley, Keith C. Radley *, Heather M. Whipple

Department of Psychology, University of Southern Mississippi, Hattiesburg, MS, United States

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The present study evaluated and compared the effects of social stories and video modeling on eye contact of adolescents with autism spectrum disorder (ASD). A multiple baseline design across participants with embedded changing conditions, counterbalanced across groups (A/B/B+C and A/C+C+B) was utilized to investigate the differential effects of social stories, video modeling, and a combination of social stories and video modeling. Results indicate that social stories presented in isolation resulted in moderate improvements in eye contact, with further improvements observed upon introduction of the combined social stories and video modeling intervention. Video modeling in isolation was found to result in strong intervention effects, with the addition of social stories yielding minimal additive effect. Implications for practice, limitations, and directions for future research are discussed.

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Autism spectrum disorder (ASD) is characterized by repetitive behavioral patterns and difficulties engaging in successful social interactions due to verbal and nonverbal communicative deficits (American Psychological Association, 2013). The social deficits exhibited by individuals with ASD are unlikely to diminish over time and may become more apparent as individuals with ASD enter adolescence and encounter increasingly complex social settings (Tantam, 2003). As the prevalence of individuals diagnosed with ASD has increased (Center for Disease Control, 2014), so has the need for effective and practical intervention procedures targeting associated social deficits.

The social deficits exhibited by individuals with ASD have been indicated as the most defining characteristic, regardless of language or cognitive abilities (Carter, Davis, Klin, & Volkmar, 2005). Common verbal communicative deficits include difficulty sharing conversations (Elder, Caterino, Chao, Shacknai, & DeSimone, 2006), maintaining topics of conversation (Gutstein & Whitney, 2002), and inappropriate speech prosody (Starr, Szatmari, Bryson, & Zwaigenbaum, 2003). Nonverbal communicative deficits include difficulty recognizing facial expressions (Celani, Battacchi, & Arcidiacono, 1999) and sustaining appropriate eye contact (Pelios & Lund, 2001; Senju & Johnson, 2009).

It has been suggested that insufficient levels of eye contact represent a foundational nonverbal communicative deficit of ASD (Senju & Johnson, 2009) that is likely to restrict the development of other social skills (Donnelly, Luyben, & Zan, 2009), including other nonverbal communication skills. Koegel and Frea (1993), for instance, evaluated a pivotal response training
procedure toward the acquisition and generalization of social communicative behaviors on other social behaviors and found that promoting eye contact facilitated the development of conversational topic maintenance as well as nonverbal mannerisms. In addition to promoting the development of other skills, the inability to sustain adequate eye contact is associated with noncompliance (Hamlet, Axelrod, & Kuerschner, 1984), and may negatively impact the academic performance of students with ASD given the importance of eye contact for attending to classroom instruction (Greer & Ross, 2007).

Given the associated detriments, researchers have evaluated a number of methods rooted in applied behavior analysis for promoting social skills, including eye contact. Social skills interventions are the most frequent intervention methods used to address both verbal and nonverbal social deficits of individuals with ASD (Goin-Rochel, Myers, & Mackintosh, 2007). The mechanisms facilitating the teaching of discrete skills typically include a combination of observation, modeling, and opportunities for skill rehearsal with positive and/or corrective feedback (Elliott, Roach, & Beddow, 2008). Two frequently used social skills intervention procedures include social stories and video modeling.

Social stories are brief, individualized narratives that describe social concepts or difficult social situations, and direction for successful and appropriate responses during those situations (Gray, 2000). Recent meta-analyses of social story interventions have indicated substantial variability of effects across studies (Kokina & Kern, 2010; Reynhout & Carter, 2006), with researchers suggesting that social story interventions may be more effective toward reducing inappropriate behaviors than increasing new social skills (Kokina & Kern, 2010). Despite this, Schneider and Goldstein (2009) suggested that social story interventions may be well suited to address deficits of eye contact, and there is evidence to suggest that social stories may promote eye contact deficits demonstrated by individuals with ASD. For instance, social stories using pictures were used to improve eye contact of a child with ASD (Pierson & Glaeser, 2007). In addition, Soensken and Alper (2006) utilized a social story intervention to teach a young child with ASD to solicit the attention of peers by saying their name or by looking at their peer’s face, finding the intervention to produce small to moderate improvements.

Similar to social stories, video modeling may be utilized to promote social skill use in individuals with ASD. Video modeling describes the procedure of having an individual watch a video of a model demonstrating a target behavior. There are a number of variations of video modeling procedures, including video self-modeling (Dowrick, 1999) and point of view video modeling, but the essential components are consistent across variations; namely, accurate skill demonstration. Video modeling interventions have been used to improve a variety of social deficits of individuals with ASD (Bellini, Peters, Brenner, & Hopf, 2007), including spontaneous requesting (Wert & Neisworth, 2003), perspective taking (LeBlanc et al., 2003), complex play sequences (D’Ateno, Mangiapanello, & Taylor, 2003), and social initiations (Buggey, 2012). Despite the flexibility of video modeling interventions, few studies have evaluated the effects of video modeling interventions with adolescents (Delano, 2007), with researchers findings results indicating that video modeling interventions may be less effective with older children relative to use with younger children (Wang, Cui, & Parrila, 2011).

In addition, few studies have evaluated the effects of video modeling interventions toward increasing eye contact. Tetreault and Lerman (2010) used point of view video modeling to teach three young children with ASD to initiate and maintain conversations with a partner. Three behavioral scripts were developed and introduced for training using a multiple baseline design, and participants were trained to provide eye contact and verbal exchanges with partners. The researchers suggested that point of view video modeling was moderately effective toward promoting eye contact of each participant, but additional procedures (i.e., edibles, prompting) were needed to promote other target behaviors. Mason, Rispoli, Ganz, Boles, and Orr (2012) also evaluated the effects of video modeling on two college students’ eye contact, finding the intervention to produce large improvements in eye contact.

Scattone (2008) evaluated the effects of a combined intervention strategy using video modeling and social stories to improve several nonverbal communication skills, including eye contact, smiling, and initiations, of a 9-year-old boy with ASD. Using a social story developed according to Gray’s (2000) guidelines, the social story text was filmed and narrated by an adult. The social story intervention was presented first, followed by the video modeling component, which demonstrated two adults using the target skills during a 5-min conversation. After viewing both intervention components, the participant answered comprehension questions and engaged in a 5-min social interaction session, while the percentage of 10-s intervals in which the participant demonstrated eye contact was calculated. Scattone found substantial improvements of eye contact from baseline (66%) to intervention (97%), and low to moderate effects were demonstrated for smiling and initiations.

Although favorable findings were indicated, Scattone’s (2008) results should be interpreted with a number of limitations in mind. For instance, social stories and video modeling were implemented within a combined intervention, leaving questions as to whether either component contributed differentially toward improvement of eye contact, or whether a combined intervention may be more effective than either procedure used in isolation. In addition, Scattone evaluated skill generalization from clinic to school settings with a single baseline probe and a single probe following intervention, finding improved levels of target skills. However, minimal assessment of skill generalization and utilization of a combined intervention strategy left conclusions of generalization undetermined.

The issue of skill generalization is an important one, and remains one of the more challenging aspects of social skills training procedures for individuals with ASD (Barry, Klinger, Lee, Palaridy, Gilmore, & Bodin, 2003). It has been suggested that promoting skill generalization may require the systematic methodological programming within intervention procedures (Baer, Wolf, & Risley, 1968). To this end, Stokes and Osnes (1989) suggested that practitioners incorporate natural contingencies within intervention procedures; train diversely by incorporating a sufficient number of discriminative stimuli, response examples, and multiple methods of training; and to incorporate functional mediators that may enable self-control
of a target behavior or cue the target behavior under novel conditions. However, despite the continued efforts of researchers toward the development of effective intervention methods for improving the social and communicative skill deficits of individuals with ASD, promoting skill generalization across novel settings and persons continues to be a challenge, particularly with older students (Owen-DeSchryver, Carr,CALE, & Blakey-Smith, 2008). In addition, few studies have monitored the extent of skill generalization using social story interventions, limiting any conclusions concerning whether social story interventions are effective in this regard (Kokina & Kern, 2010; Reynhout & Carter, 2006).

The variety and severity of deficits, coupled with the increasing number of students identified with ASD, indicates a need for the continued development of effective and efficient interventions to remediate specific communicative deficits in training settings, and identification of intervention procedures likely to promote skill generalization. Although previous research has suggested the effects of social stories and video modeling interventions toward improving the eye contact of individuals with ASD, no study has yet systematically evaluated the relative effects of both intervention procedures toward promoting eye contact. In addition, training for and assessment of skill generalization continues to be a limitation within the social skills literature, particularly with adolescents. With these limitations in mind, the following research questions were examined:

1. Does the implementation of either intervention approach (video modeling or social stories) effectively increase the total duration of eye contact demonstrated by adolescents with ASD?
2. Does the implementation of a combined intervention approach effectively increase the total duration of eye contact demonstrated by adolescents with ASD, relative to a single intervention used alone?
3. Does the implementation of either intervention approach effectively increase the total duration of eye contact demonstrated by adolescents with ASD with a novel conversation partner?
4. Does the implementation of a combined intervention approach effectively increase the total duration of eye contact demonstrated by adolescents with ASD, relative to a single intervention used alone, with a novel conversation partner?

1. Methods

1.1. Participants and setting

Participants included six African American adolescents attending a high school from a small city in the Southeastern United States. Participant demographic information, including age, gender, race, and current special education classification are presented in Table 1. Before receiving their current special education classification, each participant received services under the developmental disability category until the age of nine. Winston, Russell, Dave, and Nick (pseudonyms used throughout) spent their entire school day within a self-contained classroom that included two special education teachers and two other students with severe disabilities. Ernie spent his entire school day receiving special education services in a community-based classroom that included three special education teachers and approximately twenty other students who also received special education services. Sam spent the majority of his school day in general education classrooms but spent parts of his day with an inclusion teacher as part of the accommodations stipulated in his Individualized Education Program (IEP). Each student was referred to a district behavior consultant for social skills intervention and included in the study due to similar social skills goals indicated in their IEP.

In addition to a review of educational records, the participants’ primary special education teacher was asked to complete the Autism Spectrum Rating Scale (ASRS; Goldstein & Nglieri, 2009) to provide a current measure of the level of ASD-related impairment of each student. These results are presented in Table 2. Importantly, current symptom severity could not be evaluated using the ASRS for Nick because he was 19 at the time of the study. Therefore, the same special education teacher was asked to evaluate symptom severity using the Children’s Autism Rating Scale, second edition standard version (CARS-2; Schloper, Van Bourgondien, Wellman, & Love, 2010). Nick received a raw score of 44 and a T-score of 61, indicating severe symptoms of ASD.

Intervention sessions were held in an office located within the community-based classroom described. The room measured 4 m by 2 m, contained two chairs, two book shelves, pictures of former students, and a cart with iPads and iPods.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Sex</th>
<th>Race</th>
<th>Disability category</th>
<th>Verbal IQ/nonverbal IQ/composite IQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winston</td>
<td>18</td>
<td>Male</td>
<td>AA</td>
<td>ASD</td>
<td>IQ scores not reported</td>
</tr>
<tr>
<td>Ernie</td>
<td>16</td>
<td>Male</td>
<td>AA</td>
<td>ID</td>
<td>68/67/63</td>
</tr>
<tr>
<td>Russell</td>
<td>17</td>
<td>Male</td>
<td>AA</td>
<td>ASD, ID</td>
<td>53/57/48</td>
</tr>
<tr>
<td>Sam</td>
<td>17</td>
<td>Male</td>
<td>AA</td>
<td>ASD</td>
<td>44/89/62</td>
</tr>
<tr>
<td>Dave</td>
<td>18</td>
<td>Male</td>
<td>AA</td>
<td>ASD</td>
<td>IQ scores not reported</td>
</tr>
<tr>
<td>Nick</td>
<td>19</td>
<td>Male</td>
<td>AA</td>
<td>ASD</td>
<td>69 (UNIT)</td>
</tr>
</tbody>
</table>

Note. AA, African American; ASD, Autism Spectrum Disorder; ID, Intellectual Disability. All participants, with the exception of Nick, were given the Reynolds Intellectual Assessment Scales to determine IQ (RIAS; Reynolds & Kamphaus, 2003). Adrian was given the Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998).
Across conditions, the primary researcher placed a 12 in. tablet on one of the book shelves to record participants’ eye contact during conversation probes with a researcher who sat opposite to individual participants. A special education teacher with 10 years of teaching experience was asked to engage in conversation with individual participants to assess skill generalization. The teacher had attained a B.A. in Psychology, with a minor in Education of the Deaf; and a M.Ed. degree in Special Education, Behavioral Disorders. She was also licensed to work with individuals with mild/moderate disabilities (K-12), and teach middle school math, social studies, and science to special education students (7–8). Two school psychology doctoral students working as district behavioral consultants facilitated experimental procedures.

1.2. Materials

Materials used in the current study included two 12 in. Samsung Galaxy tablets, a stopwatch, and tangible rewards (i.e., candy, iPad, iPod). A social story replicated from Scattone (2008) explaining the importance of eye contact, and a video model demonstrating appropriate eye contact between two conversation partners were also developed. One tablet was used for playing the social story and video model and the other was used for recording duration of eye contact during conversation probes. The stopwatch was used to measure duration of eye contact after intervention implementation. Tangible rewards were given following conversation probes during intervention conditions.

1.3. Dependent measure

The total duration of eye contact demonstrated during 3-min conversation probes with a researcher was the primary dependent measure. Conversation probes were held immediately following the implementation of the social story, video model, or combined intervention. A secondary dependent measure included the total duration of eye contact demonstrated during 3-min conversations with a novel conversation partner. Due to variability in teacher availability, one generalization probes was collected for every two to three conversation probes with a researcher.

1.4. Experimental conditions

1.4.1. Design

A multiple baseline design (Cooper, Heron, & Heward, 2007) with an A/B/B+C conditions sequence, counterbalanced across groups of three participants was utilized to assess the relative effects of social stories and video modeling toward increasing the total duration of eye contact. Participants were randomly assigned to one of two intervention sequences, with each sequence consisting of three total participants. Experimental conditions for Group 1, comprised of Winston, Ernie, and Russell, included (A) baseline, (B) social stories, (B+C) and social stories plus video modeling. Experimental conditions for Group 2, comprised of Sam, Dave, and Nick, included (A) baseline, (C) video modeling, and (C+B) video modeling plus social stories. Intervention conditions were counterbalanced across groups to control for sequence effects.

1.4.2. Baseline

Prior to gathering baseline data, parental consent was obtained for all participants. During baseline, one of the tablets was placed behind the researcher for recording of participants’ eye contact. Participants engaged in 3-min conversations initiated by the researcher, who began each probe by asking “What would you like to talk about today?” During probes, the participant’s eye contact was never solicited and the researcher did not provide positive or corrective feedback during or following conversation probes. However, researchers provided many alternative topics of conversation if participants were unable to continue conversations. Following conclusion of each baseline conversation, video recordings were reviewed and total duration of eye contact was calculated.

1.4.3. Social stories

For Winston, Ernie, and Russell, intervention first consisted of introduction of social stories in isolation. Participants were seated directly in front of the primary researcher during each session, with one tablet placed behind the researcher for recording participants’ eye contact. The researcher first explained the importance of and basic rationale for sustaining eye
contact with peers. The participant then viewed the social story on a tablet computer, which was replicated from Scattone (2008). The social story, which was 45 s long and consisted of written text and audio narration, identified individuals the participants were likely to interact with in the school setting, and indicated the importance of sustaining eye contact during those interactions. Specifically: “When I come to school, I see lots of people. Some are teachers. Some are kids! Usually someone talks to me. When someone talks to me, I will try to make eye contact. Most people like it when I make eye contact. Making eye contact makes them feel good. This lets them know I’m listening. If I look at them when I am talking, they will like this a lot. They will think I’m nice. I will try to make eye contact most of the time we are talking.”

Participants were then asked three comprehension questions, including who they see at school, what they should do when they talk to people, and whether people like it when they give them eye contact. Participants were asked these questions until they provided correct responses. Next, participants were told that they would be engaging in a conversation. To control for a potential performance deficit, whereby participants demonstrated poor eye contact due to lack of incentive rather than an inability to do so, they were told they could earn a tangible reward for engaging in a good conversation with the researcher (i.e., candy, access to an iPad, or access to an iPod); although rewards were given regardless of performance. The selection of prizes was indicated by their respective teachers as preferred tangible items. The 3-min conversation, in which total duration of eye contact was measured, initiated when the researcher asked participants what they would like to talk about. Video recordings of conversations were reviewed and duration of eye contact was calculated following each conversation.

### 1.4.4. Video modeling

For Sam, Dave, and Nick, video modeling was first introduced in isolation. With the exception of viewing a video model instead of a social story, the video modeling intervention condition was identical to the social story intervention condition. Participants were seated directly in front of the researcher who explained the importance and rationale for sustaining eye contact. The video model was then shown to participants on a tablet computer and was 3 min and 45 s in duration. The video model opened and closed with audio narration and text stating “Make eye contact when you talk to people!” Two researchers were shown throughout the video model engaging in conversation while seated directly across from each other. Every 30 s the conversation was briefly paused for approximately 5 s and a close view of an individual researcher was shown displaying eye contact, with text reading “Good eye contact!” and audio narration stating “He’s giving great eye contact!” or “Remember to keep giving great eye contact!” The most frequent topic of conversation discussed during baseline conversations with each participant was noted, and a brief conversation about each topic of interest was included in the video model. As such, the video model viewed by participants consisted of conversation regarding six topics (i.e., Pokemon, Whitney Houston, exercise, Disney movies, Naruto, and video games). This was done for two reasons: first, it ensured some level of sustained attention from participants while the video model was playing by incorporating special interests of participants (e.g., Baker, Koegel, & Kopegel, 1998; Campbell & Tincani, 2011; Vismara & Lyons, 2007); second, it provided multiple stimulus exemplars (e.g., Stokes & Baer, 1977), demonstrating conversation topics they were likely to encounter with their peers.

The same three comprehension questions were then asked until correct responses were provided, the participant was told of the forthcoming conversation, and told of the availability of prizes. The 3-min conversation began when the researcher asked what they would like to talk about, and video recordings of conversations were reviewed and duration of eye contact was calculated following each conversation.

### 1.4.5. Combined intervention conditions

The same procedures were used during combined intervention conditions across groups. Group 1 first viewed the social story followed by the video model, and Group 2 viewed the video model prior to viewing the social story. Both groups were then engaged in conversation by a researcher as in previous experimental conditions.

### 1.4.6. Generalization

Due to variability in teacher availability, generalization of eye contact was assessed following every two or three conversation probes with a researcher. Participants were seated directly in front of a familiar special education teacher with whom each of the participants were likely to interact with on a day-to-day basis. As during all other conditions, one tablet was placed behind the teacher for recording participants’ eye contact and the 3-min conversation began when she asked participants what they would like to talk about. As during baseline, the participant’s eye contact was never solicited and participants were not provided positive or corrective feedback during or following conversation probes. However, the teacher provided many alternative topics of conversation if participants were unable to continue conversations. Participants were not told of and did not gain access to tangible rewards following conversations. Video recordings of conversations were reviewed and the duration of eye contact was calculated following each conversation.

### 1.5. Interobserver agreement

The total percentage of agreement of duration of eye contact between two independent researchers was calculated to provide a percentage of interobserver agreement (IOA). IOA was obtained by two researchers reviewing and coding eye contact during video recorded conversations. The total duration of eye contact calculated by one observer was divided by the total duration of eye contact calculated by an independent secondary observer and multiplied by 100. IOA was calculated for 32.5% of intervention (i.e., training) sessions. Additionally, IOA was calculated for at least 20% across all participants.
(range = 22.22–39.1%). Mean IOA was 97.3%, 95.9%, 94.5%, 97.1%, 96.9%, and 95.2% for participants 1 through 6, respectively (range = 90.5–100% across all participants). IOA was calculated for 57.5% of all generalization probes. Mean IOA for generalization was 96.4%, 95.4%, 94.0%, 98.1%, 93.4%, and 98.0% for participants 1 through 6, respectively (range = 90.0–100%).

1.6. Procedural integrity

The extent to which intervention procedures were implemented as intended was assessed in a 'yes' or 'no' fashion using an implementation checklist at the conclusion of each session. Procedural integrity was calculated by dividing the total number of steps completed by the number of steps possible and multiplying by 100. Procedural integrity was 100% across conditions. Procedural integrity IOA was calculated for 32.5% of sessions by two researchers who completed the checklist independently. Procedural integrity IOA was 100% across all sessions in which it was assessed.

1.7. Data analysis

Eye contact during training and generalization probes was graphed and visually analyzed as the duration of total eye contact (in seconds) during 3-min conversation probes. The effects of intervention(s) on the duration of eye contact were evaluated by inspecting data trend, level, and variability around trend and level, within and between experimental conditions. Phase change decisions were made based on the stability of duration of eye contact, operationalized as 15–20% variability, and increasing/decreasing data trends.

Two single case effect sizes, nonoverlap of all pairs (NAP; Parker & Vannest, 2009) and Tau-U (Parker, Vannest, Davis, & Sauber, 2011) were also calculated to assess the effectiveness of interventions on participants’ duration of eye contact during training probes. NAP and Tau-U were calculated by comparing data within baseline conditions to data within intervention conditions consisting of a single intervention (i.e., A vs. B or A vs. C) and by comparing data within single intervention conditions to data within combined intervention conditions (i.e., B vs. B+C or C vs. C+B). NAP scores represent the likelihood that a single data point within a selected condition will exceed a data point within a selected comparison condition (Parker & Vannest, 2009). Tau-U also produces an analysis of non-overlap, with the addition of controlling for data trend of selected conditions, resulting in a more conservative estimate of intervention effect (Parker et al., 2011). NAP and Tau-U produce scores between 0.00 and 1.00. Parker and Vannest (2009) provided guidelines used to determine the magnitude of effect sizes for NAP. Effect size scores of 0.00–0.65 are considered weak, scores of 0.66–0.92 are considerate moderate, and scores of 0.93–1.00 are considered strong (Parker & Vannest, 2009). Although there are no published guidelines for interpreting Tau-U, the existing guidelines for interpretation of NAP offer a conservative estimate of effect considering trend control available in Tau-U.

2. Results

The duration of eye contact in seconds during 3-min conversations in training settings, and the extent to which participants generalized their use of eye contact with a novel conversation partner was calculated across conditions.

2.1. Group 1

During baseline, Winston demonstrated near zero levels of eye contact in the training setting (M = 3.3 s, range = 1–6 s) and during assessment of generalization (M = 7.5 s, range = 7–8 s; Fig. 1). With the implementation of the social story intervention, duration of eye contact moderately improved, demonstrating an initial increasing trend, but ending with a return to baseline levels (M = 30.5 s, range = 8–57 s). Small improvements were demonstrated with the implementation of the social story intervention during assessment of generalization (M = 18.0 s, range = 13–23 s). Total seconds of eye contact for Winston immediately improved with the addition of video modeling relative to social stories alone and remained stable throughout intervention (M = 56.43 s, range = 49–58 s). Assessment of generalization also indicated improved duration of eye contact (34 s) relative to the social story alone condition. Calculation of NAP comparing the duration of eye contact during baseline to the social story intervention indicated a strong effect (NAP = 1.00). Comparisons between social stories alone and a combined intervention indicated a moderate effect (NAP = 0.92). Calculation of Tau-U comparing duration of eye contact during baseline to the social story intervention indicated a strong effect (Tau-U = 1.00). Comparisons between social stories alone and a combined intervention indicated a moderate effect (Tau-U = 0.84). See Table 3 for effect size calculations.

During baseline, Ernie demonstrated low levels of eye contact in the training setting (M = 26.2 s, range = 17–43 s) and during assessment of generalization (M = 24.0 s, range = 19–29 s; Fig. 1). The duration of eye contact improved with implementation of the social story intervention. An increasing trend was demonstrated at first, followed quickly by a decreasing trend, which stabilized near baseline levels (M = 74.4 s, range = 42–125 s). During assessment of generalization, the duration of eye contact increased relative to baseline (M = 54.0 s, range = 37–67 s). With the addition of the video modeling intervention, the duration of eye contact immediately improved, demonstrated small variability, and ended with an increasing trend (M = 99.8 s, range = 69–136 s). Assessment of generalization demonstrated improved and stable levels of eye contact relative to social stories alone (M = 77.5 s, range = 37–87 s). Effect size calculations comparing baseline to social
stories alone indicated strong (NAP = 0.98) to moderate effects (Tau-U = 0.90). Effect size calculations comparing social stories alone and a combined intervention indicated moderate effects (NAP = 0.76; Tau-U = 0.69).

Russell demonstrated low to moderate levels of eye contact during baseline in the training setting (M = 64.1, range = 42–93) and during assessment of generalization (M = 53.0, range = 26–83; Fig. 1). Improved eye contact was demonstrated immediately with the introduction of social stories, but displayed a decreasing trend that stabilized with a return to or slightly below baseline levels (M = 67.2 s, range = 36–126 s). Assessment of generalization also demonstrated below baseline levels of eye contact (M = 24.5 s, range = 20–29 s). The duration of eye contact for Russell immediately improved to a high

Table 3
Nonoverlap of all pairs and Tau-U values depicting changes in duration of eye contact across participants (baseline vs. social story or video model, social story or video model vs. combined intervention).

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline vs. social story</th>
<th>Social story vs. combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NAP value/effect</td>
<td>Tau-U value/effect</td>
</tr>
<tr>
<td>Winston</td>
<td>1.00/strong</td>
<td>1.00/Strong</td>
</tr>
<tr>
<td>Ernie</td>
<td>0.98/strong</td>
<td>0.90/Moderate</td>
</tr>
<tr>
<td>Russell</td>
<td>0.48/weak</td>
<td>0.17/Weak</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline vs. video model</th>
<th>Video model vs. combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NAP value/effect</td>
<td>Tau-U value/effect</td>
</tr>
<tr>
<td>Sam</td>
<td>1.00/strong</td>
<td>1.00/strong</td>
</tr>
<tr>
<td>Dave</td>
<td>0.98/strong</td>
<td>0.96/strong</td>
</tr>
<tr>
<td>Nick</td>
<td>1.00/strong</td>
<td>1.00/strong</td>
</tr>
</tbody>
</table>

Note. NAP, nonoverlap of all pairs (Parker & Vannest, 2009).
level with the addition of the video modeling intervention and remained stable ($M = 166.6$ s, range $= 160–170$ s). It is important to note that Russell was hospitalized during the combined intervention phase, indicated by a break between data points, preventing assessment of generalization. Effect size calculations comparing baseline to social stories alone indicated weak effects (NAP = 0.48; Tau-U = 0.17). Effect size calculations comparing social stories alone and a combined intervention indicated strong effects (NAP = 1.00; Tau-U = 1.00).

2.2. Group 2

During baseline, Sam demonstrated low levels of eye contact in the training setting ($M = 45.7$ s, range $= 31–67$ s) and moderate levels during assessment of generalization ($M = 87.0$ s, range $= 77–97$ s; Fig. 2). Once the video modeling intervention was implemented, eye contact improved immediately to a high level and remained stable in both the training setting ($M = 170.8$ s, range $= 166–174$ s) and during assessment of generalization ($M = 170.0$ s, range $= 165–175$ s). The social story intervention did not have an additive effect on the duration of eye contact, with levels of eye contact remaining stable at a high level in the training setting ($M = 168.8$ s, range $= 58–174$ s) and during assessment of generalization ($M = 172.3$ s, range $= 165–177$ s). Effect size calculations comparing baseline to video modeling alone indicated strong effects (NAP = 1.00; Tau-U = 1.00). Effect size calculations comparing video modeling alone and a combined intervention indicated weak effects (NAP = 0.42; Tau-U = 0.08).

During baseline, Dave demonstrated low to moderate levels of eye contact in the training setting ($M = 40.4$, range $= 13–62$) and low levels during assessment of generalization ($M = 20.5$ s, range $= 20–21$ s; Fig. 2). The duration of eye contact immediately improved with the implementation of the video modeling intervention. Although the data trend decreased for a short period, data trend increased and stabilized at the end of the intervention condition and level of eye contact was above baseline level for all but one intervention session ($M = 93.4$ s, range $= 59–118$ s). Improved eye contact was also demonstrated relative to baseline during assessment of generalization with implementation of the video modeling.

![Fig. 2. Seconds of eye contact during 180-s conversation, Group 2. Note. BL = baseline, VM = video model, VM + SS = combined video model and social story.](image-url)
intervention (M = 82.3 s, range = 48–122 s). The addition of the social story intervention had small additive effects on the duration of eye contact for Dave, with the duration of eye contact remaining stable at a similar level (M = 112.3 s, range = 94–130 s). Assessment of generalization also indicated similar durations of eye contact (M = 103.3 s, range = 65–133 s) with the addition of the social story intervention. Effect size calculations comparing baseline to video modeling alone indicated strong effects (NAP = 0.98; Tau-U = 0.96). Effect size calculations comparing video modeling alone and a combined intervention indicated moderate (NAP = 0.77) to weak effects (Tau-U = 0.53).

During baseline, Nick demonstrated low to near zero levels of eye contact in the training setting (M = 11.3 s, range = 2–28 s) and low levels during assessment of generalization (M = 40.5 s, range = 29–66 s; Fig. 2). The duration of eye contact immediately improved with implementation of the video modeling intervention, demonstrated an increasing trend at first, but decreased slightly and stabilized at a high level (M = 142.5 s, range = 121–175 s). Improved eye contact was also demonstrated relative to baseline during assessment of generalization (M = 118.8 s, range = 92–163 s). The addition of the social story intervention yielded no additive effects on the duration of eye contact in the training setting (M = 124.5 s, range = 110–134 s) or during assessment of generalization (M = 111.3 s, range = 107–116 s). Effect size calculations comparing baseline to video modeling alone indicated strong effects (NAP = 1.00; Tau-U = 1.00). Effect size calculations comparing video modeling alone and a combined intervention indicated weak effects (NAP = 0.20; Tau-U = 0.59).

3. Discussion

The purpose of the current study was to compare the relative efficacy of social stories, video modeling, and a combined social stories and video modeling intervention for increasing eye contact of adolescents with ASD in training and generalized contexts. Results of the study indicated that when introduced alone, social stories resulted in moderate improvements in eye contact ranging from weak to strong effects. The addition of video modeling to the social story intervention resulted in improved and maintained levels of eye contact for all three participants assigned to Group 1. Similar data trends were demonstrated across conditions during assessment of generalization for Group 1. For participants assigned to Group 2, introduction of video modeling resulted in large and immediate increases in eye contact. Subsequent addition of social stories to the video modeling intervention was found to have no appreciable effect on the duration of eye contact during conversation probes for any of the participants assigned to Group 2. Similar data trends were again demonstrated across conditions during assessment of generalization for Group 2.

The sequential introduction of intervention components combined with counterbalancing intervention sequence across groups allows for comparison of the relative efficacy of social stories and video modeling for promoting eye contact in individuals with ASD. As eye contact improved upon addition of video modeling for participants assigned to Group 1, and no meaningful improvement in eye contact were observed for participants assigned to Group 2 following addition of the social story, findings of the current study indicate that video modeling may more effectively address deficits in eye contact than social stories. It is also important to note that combined social story and video modeling interventions (Scattone, 2008) appear to be no more effective than video modeling in isolation in either training or generalized contexts. Taken together, results indicate that practitioners should consider video modeling as a more efficient, and often more effective, alternative to either social story or combined social story and video modeling intervention approaches.

The effects of social stories on eye contact observed in the current study are consistent with previous research on social story interventions for increasing eye contact, which indicate variable effects of the intervention (Soenksen & Alper, 2006). Similarly, participants in the current study who received social stories in isolation demonstrated effects on eye contact ranging from weak to strong—indicating that social stories may not be a suitable intervention strategy for all individuals with ASD. Although all participants in Group 1 demonstrated initial improvements in eye contact, it is important to note that improvements in eye contact were not maintained following continued exposure to the social story for any participant in Group 1. The failure of social stories to produce more substantial, maintained, and generalized effects on eye contact may be due to the fact that the social story did not provide multiple examples of discriminative stimuli for eye contact (Stokes & Osnes, 1989). The relative inefficacy of social stories in increasing eye contact may also be due to findings that social stories are more useful for decreasing inappropriate behaviors than for promoting prosocial behavior (Kokina & Kern, 2010).

Although Wang et al. (2011) indicated that video modeling interventions may be most effective for young children with ASD, results of the current study demonstrate the utility of the intervention for adolescents with ASD. Across all participants, implementation of video modeling procedures was associated with improved eye contact that was maintained throughout the intervention phase. Additionally, generalization of eye contact across persons was also noted for all participants. As generalization of intervention effects has been noted to be particularly challenging for older students with ASD (Owen-DeSchryver et al., 2008), video modeling, particularly video models that incorporate multiple discriminative stimuli for eye contact (e.g., audio narration and text prompts, close view of eyes), may represent an effective strategy for increasing generalized use of eye contact.

In analyzing the results of the current study, the researchers conclude that the intervention procedures were effective for improving eye contact, with video modeling being associated with larger improvements than social stories in both training and generalized contexts. However, several limitations of the current study should be considered. Although poor eye contact may negatively influence use of other social skills (Donnelly et al., 2009), compliance with requests (Hamlet et al., 1984), and academic competence (Greer & Ross, 2007), no assessment of these behaviors was included in the current study. Future researchers should investigate whether improvements in eye contact as demonstrated in the current study are associated
with collateral improvements in other areas of functioning. Second, generalization probes were not collected for Russell during the combined intervention phase due to sporadic attendance associated with hospitalization. Although data from all other participants indicate improved generalization following introduction of video modeling, future research should ensure collection of generalization data for all participants. Relatedly, assessment of generalization took place with a familiar teacher. As familiarity with the teacher may have affected participant use of eye contact, future researchers should assess generalization to novel, unknown, or unfamiliar persons. The current study is also limited by a lack of maintenance data. As such, it is unknown whether improvements in eye contact would be maintained following discontinuation of intervention procedures. In addition, despite low levels of eye contact during baseline for all participants, issues of reactivity may have been present given that the tablet was placed within view of participants. Future researchers may consider use of more discrete methods for measuring eye contact (e.g., ceiling-mounted cameras). Although all participants in the current study demonstrated improvements in eye contact, it is unknown whether participants demonstrated eye contact at levels comparable to same-aged peers. In some cases (e.g., Sam), eye contact at near 100% may be considered inappropriate. Future researchers should investigate and target developmentally appropriate levels of eye contact. Although the current study controlled for potential sequence practice effects by counterbalancing video modeling and social stories conditions across groups, the combined intervention condition occurred last for both groups. Future researchers may consider further controlling for sequence and practice effects by counterbalancing all intervention conditions.

4. Conclusion

Eye contact represents a nonverbal pragmatic skill necessary for successful social interaction (Soensken & Alper, 2006), and atypical eye contact has been identified as a significant impairment in ASD (Senju & Johnson, 2009). Results of the current study suggest that social story interventions are relatively less effective than video modeling for improving eye contact in both training and generalized contexts, with video modeling presented in isolation resulting in intervention effects equivalent to combined video modeling and social story interventions. As such, practitioners addressing eye contact of individuals with ASD may consider video modeling as an effective and resource-efficient intervention strategy.

References


