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STORIES THAT CONNECT: A MULTIPLE-BASELINE EXAMINATION OF SOCIAL NARRATIVES FOR STUDENTS WITH AUTISM SPECTRUM DISORDER

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Abstract

The present study examined the effects of digital social narratives, delivered through technology, on the social interactions of elementary-aged students with autism spectrum disorder (ASD) in inclusive settings. Using a multiple-baseline design across participants, the study investigated whether brief social narratives presented on personal devices could increase verbal and nonverbal peer interactions during recess. Three male students, ages 7 years 6 months to 9 years 10 months, participated. Baseline observations showed minimal peer engagement (M = 1.2%). Following intervention, appropriate social interactions increased to an average of 57.9%, with notable gains in nonverbal behaviors such as eye contact, proximity, and shared play. Although a functional relationship was not established, each participant demonstrated gains from baseline to intervention. Four to six maintenance probes were conducted after the intervention ceased and all three participants demonstrated levels of appropriate social interaction higher than baseline. Additionally, educators rated social validity high. Implications for practitioners and researchers are discussed.

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Introduction

Students with autism spectrum disorder (ASD) often struggle to make and maintain social connections in school, home, and community environments. ASD is a neurodevelopmental condition characterized by struggles in communication and restricted or repetitive patterns of behavior, interests, or activities (American Psychiatric Association, 2024). Among the hallmark challenges of ASD are difficulties with reciprocal social interaction, initiating, maintaining, and responding appropriately during social exchanges. As increasing numbers of children with ASD are educated in inclusive settings under the Individuals with Disabilities Education Act (IDEA, 2004), educators face a dual imperative: to foster academic achievement and to facilitate meaningful social participation within general education classrooms and playgrounds. The inclusive classroom presents opportunities for rich social learning, yet these opportunities often remain inaccessible to students with ASD without intentional support.

Theoretical and Empirical Background

One way to increase social interactions for children with ASD is by implementing social narratives, which have been used for the past thirty years. One specific type of social narrative is a Social Story™, first developed by Carol Gray (Gray & Garand, 1993). These were designed to help individuals with ASD understand social expectations through structured narratives that describe social contexts, the perspectives of others, and appropriate behavioral responses. Social Stories™ are a specific type of the broader umbrella term of social narratives. These narratives employ clear, concise language to communicate social rules and norms that neurotypical peers often acquire intuitively. Traditionally, social narratives have been paper-based and teacher-delivered, focusing on predictable social situations such as greeting others, joining a group, or taking turns. More recent research has explored the application of digital social narratives, those delivered through multimedia platforms such as computers, tablets, or handheld devices (Anthony & Bobzien, 2022).

The integration of technology aligns well with the learning profiles of many students with ASD, who often demonstrate strong visual processing abilities and intrinsic motivation for interacting with electronic media. The portability and discreteness of digital formats also make them particularly suitable for use in inclusive classrooms, where stigmatization and visibility of interventions can otherwise present barriers. Additionally, recent research reflects the intentionality of studies designed to improve the quality of studies while concurrently increasing the reported efficacy of the intervention (Como et al., 2024; Hanrahan et al., 2020; Karal & Wolfe, 2018; Qi et al. 2018; Aldabas, 2018).

Purpose and Research Questions

The purpose of this study was to evaluate the effectiveness of digital social narratives delivered via hand-held, personal devices in increasing appropriate social interactions among students with ASD during inclusive recess settings. The study aimed to determine whether these technology-mediated stories could improve both verbal and non-verbal social

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engagement and whether teachers and support staff perceived the intervention as practical and socially valid. Three primary research questions guided the investigation:

1. Does the use of digital social narratives increase the frequency of appropriate social interactions among students with ASD in inclusive settings?
2. Are both verbal and non-verbal social behaviors positively affected by the intervention?
3. How do educators evaluate the social validity and feasibility of implementing digital social narratives in their daily practice?

Significance of the Study

The significance of this study lies in its convergence of two contemporary priorities in special education: the use of *evidence-based practices* and the integration of *assistive and instructional technology*. As educational institutions increasingly emphasize inclusion, educators must be equipped with strategies that are both effective and adaptable to diverse classroom contexts. Digital social narratives represent an evolution of a well-established intervention, combining empirical support with technological innovation. By exploring their implementation in authentic, peer-based settings, this study contributes to the understanding of how technology-enhanced social interventions can support full participation and engagement for students with ASD.

Conceptual Overview

Social communication and interaction challenges are among the defining features of autism spectrum disorder (ASD), often manifesting as difficulties in understanding social norms, interpreting nonverbal cues, and engaging in reciprocal interactions. Behavioral and cognitive research has emphasized the value of targeted interventions, such as social narratives and technology-assisted learning tools, to promote social understanding and Theory of Mind (ToM) development. Recent empirical work, particularly through single-case research designs (SCRDs), has provided insight into how individualized interventions can facilitate meaningful social change among children and young adults with ASD.

Social Narratives as a Framework for Social Understanding

Social narratives and Social Stories™ have been extensively validated as structured, evidence-based tools that use descriptive and directive statements to clarify social expectations. The studies reviewed collectively highlight that such narratives function as behavioral rehearsal mechanisms, providing explicit models of appropriate social behavior, thereby enhancing generalization and self-regulation. Earlier studies (e.g., Camilleri, 2022; Smith, 2020; Wahman et al., 2022) demonstrated the consistent utility of social narratives in improving prosocial behaviors such as turn-taking, initiating conversation, and sharing. Although delivery modalities varied and ranged from printed stories to digitally mediated formats, all studies shared a focus on personalizing the narrative content to the child's developmental level and communicative ability. Digital formats (Smith, 2020) demonstrated enhanced engagement and autonomy, aligning with findings that individuals with ASD often

respond more favorably to visual and technology-mediated interventions where traditional paper stories sometimes fall short. Hence, digital formats, which are user-preferred, enhance engagement and independence, reflecting the strong response of individuals with ASD to visual and technology-mediated learning (Anthony & Bobzien, 2022).

Behavioral and cognitive research has emphasized the value of targeted interventions, such as social narratives and technology-assisted learning tools, to promote social understanding and Theory of Mind (ToM) development. Empirical work published in the last 25 years, particularly through single-case research designs (SCRDs), has provided nuanced insight into how individualized interventions can facilitate meaningful social change among children and young adults with ASD (Golzari, Alamdarloo, & Moradi, 2015, Karayazi, Kohler Evans, & Filer, 2014; Litras, Moore, & Anderson, 2010; Sansosti, & Powell-Smith, 2006; Safi, Alnuaimi, & Sartawi, 2022; Scattone et al. 2002).

Social Stories™ and social narratives, are validated tools that use descriptive and directive statements to teach understanding through behavioral rehearsal. Research shows that, when implemented with rigor and fidelity, these narratives may improve prosocial behaviors such as turn-taking, initiating conversation, and sharing when personalized to each child's developmental level and communication skills (Camilleri, 2018; Smith, 2020; Wahman et al., 2022).

Recent advancements extend narrative-based interventions into digital and immersive formats, such as interactive media and virtual reality (VR), to promote perspective-taking and Theory of Mind skills (de Souza Franco et al., 2025). Integrating Social narratives with VR-like experiences offers a promising hybrid model, one that capitalizes on the strengths of both structured narrative teaching and immersive, experiential learning.

These approaches allow participants to experience lifelike social situations, enhancing social validity and sustained learning. Across studies, single-case designs have demonstrated that both narrative and VR-based interventions, grounded in behavioral principles like modeling and reinforcement, effectively develop social understanding as a learned, observable skill. The convergence of cognitive and behavioral approaches highlights the promise of multimodal, technology-supported instruction to develop durable, generalized social competence among individuals with ASD.

Below is a description of a single case design study, employing multiple baseline across participants to examine the effectiveness of social narratives to increase social interaction in inclusive settings for children with ASD.

Method

Setting

This study was implemented in a suburban public school district located outside a large metropolitan area in the Northeast. The school district reflects the following ethnic composition: 3.5% African American or Black, 1.6% Hispanic or Latino, 9.1% Asian or other

Pacific Islander, and 84.4% white. Approximately 1,154 or 9.4% of students were classified as having a disability. Sixty-six children or 5.1% of students receiving special education services were classified as having autism, making this district the second highest of 28 districts within the region in terms of numbers of students classified as having autism. The ratio of the students in this elementary school was highly skewed towards students with typical development, creating an optimal environment for peer interactions for the students with ASD participating in this study.

The intervention was implemented in the special education classroom as participants viewed their social narrative individually on hand-held devices. Data were collected daily during recess, which occurred after lunch, and held either outdoors on a large playground when weather permitted, or indoors in the gymnasium when weather was inclement. Recess provided naturalistic contexts for observing spontaneous social behaviours. Recess was also selected because it represents an unstructured environment where social skills are particularly relevant but less likely to be scaffolded by adult direction. This setting allowed for the observation of authentic social interactions in real time.

Recruitment, Consent and Assent

Participants were recruited with the assistance of the classroom teachers who identified those students with an educational classification of autism and who struggled with social interaction. The researcher's introductory letter was sent to parents. If parents indicated they were interested in participation, they met with the researcher individually for a study overview and opportunity to ask individual questions.

IRB approval was received by the affiliated university and was shared with the hosting school district. Parental consent in writing was also received. All three of the participants in this study were able to provide student assent, indicating they agreed to participate in the study.

Participants

Three male elementary-aged students diagnosed with autism spectrum disorder (ASD) participated in this study. Additionally, each participant had an educational classification of autism and, as such, qualified for special education services. Each participant had a self-contained, multi-grade classroom which served as a "home base" for small group instruction. The specialized classroom provided students an opportunity to regroup or decompress when dysregulated. Participants spent a portion of their day included in a general education classroom, for academics or other subjects. Lastly, each participant demonstrated verbal communication skills sufficient to provide assent and participate in social story-based intervention activities.

The students with ASD participated in the general education program to varying degrees as per their Individualized Education Plans or IEPs. Some participants spent the majority of the school day within the special education classroom but joined their neurotypical peers in

inclusive opportunities for lunch, assemblies, homeroom, and curriculum specials, such as art, chorus, physical education, computer technology, and library. In addition to these inclusive opportunities, some students also participated in general education content classes, such as math, social studies, or science. Student participation in general education classes necessitated additional supervision, usually in the form of shared aide support.

Participant descriptions below briefly illustrate individual developmental histories, communication characteristics, and social profiles, as well as the focus of each participant's individualized Social Story™ intervention. The Social Story™ was written in conjunction with feedback from the classroom staff and in alignment with the participants' social, management or behavioral IEP goals. This step also included obtaining photographs of each participant engaging in socially appropriate behavior, and writing accompanying text for each photograph, following the guidelines for writing a Social Story™ in accordance with Carol Gray's guidelines.

Brandon

Brandon was the youngest participant, a bi-racial, bilingual 7-year-5-month-old second-grade student who had recently relocated to the area with his family. After early developmental concerns, he received an ASD diagnosis shortly before age four. Dissatisfied with the special education services in their native state, his parents researched educational systems across the country and discovered his present school and program. Although Spanish was frequently spoken in his home during early childhood, Brandon communicated primarily in English in school, receptively and expressively.

Brandon's expressive language skills were not at the level of his same-aged peers but could convey wants and needs and maintain short conversations with adult prompting. He was emotionally expressive, frequently smiling, hugging, and greeting others, interacting more readily with adults than peers. His preferred activities involved building with Legos or wooden blocks, during which he became highly absorbed and often unaware of surrounding social activity. Despite frequent peer invitations to collaborate on construction projects, Brandon engaged primarily in solitary play and was reluctant to share materials. Brandon's peers often invited him to help build, but would decline, not by verbally saying "no, thanks," but by turning his back and orienting his body away from his peers. If Brandon saw a peer with a square block (his preferred shape), he would take it for his pile without saying anything.

Brandon's individualized Social Story™ focused on the importance of acknowledging a peer when spoken to and sharing materials. His story also discussed collaborative play and readily joining others when invited to play, in an attempt to decrease his isolate play while in physical proximity of others. Brandon had the verbal ability to interact appropriately with peers during these activities, so his story provided him with the age-appropriate language and scripts to do so. One of the goals of Brandon's story was to teach him responses through

concrete social scripts and modeled language that would allow him to be viewed as more socially responsive in the eyes of his peers.

Allen

Allen, the oldest participant, was a black 9-year-10-month-old fourth-grade student diagnosed with ASD in preschool. He had an identical twin brother with ASD who attended a more restrictive program. Having received intensive early behavioral intervention, Allen was successfully included in general education with minimal support.

Academically, Allen demonstrated strong reading and verbal skills, though he required prompting for inferential comprehension. Allen spent the majority of his time in general education classes and participated fully in standardized, high-stakes state testing, with only a few accommodations (extended time and quiet location). Allen's verbal skills were quite strong, and he conversed with adults and peers, with some degree of prompting. Although he smiled frequently and exuded an upbeat, friendly demeanor, Allen had a quiet disposition and soft-spoken voice. He was a competent conversational partner, but frequently required prompting and coaxing to engage in social interactions with peers. His teachers and the researcher were concerned that his relaxed, laid-back personality might be misinterpreted as indifference or apathy towards his peers.

Allen was highly athletic, skilled in baseball, basketball, lacrosse, and track, which made him a popular teammate during recess. Despite frequent invitations, Allen often ignored or declined peer requests to play. If he did accept the invitation and join his peers in a physical endeavor, he would often only participate for a few minutes and then walk away, without an explanation or goodbye.

During indoor recess he gravitated toward repetitive physical activities such as pacing or manipulating a "toss-n-cup" toy, showing little verbal interaction with peers even as they admired his skill.

Allen's Social Story™ was designed to increase peer responsiveness and proactive social engagement. Through this intervention, Allen was prompted, via his story, to respond appropriately to his peers and participate in socially appropriate activities. He was also reminded through the text of his Social Story™ to acknowledge the invitation of his peers to play and to extend an invitation to them, in a proactive manner. Allen was encouraged to engage in socially appropriate, physical activities where he had the ability to excel. His story emphasized acknowledging invitations, extending invitations to others, and sustaining participation in group activities that capitalized on his athletic strengths.

Colin

Colin, age 9 years 3 months, was a white third-grade student diagnosed with ASD during preschool. He came from a large family with several members exhibiting ASD-like traits.

At the time of the study, Colin was in third grade and had been in an inclusive setting within the same school since kindergarten. Colin spent approximately 50% of his school day

in a special class and 50% of the day in a general education classroom with peers with typical development. Within his special class, Colin was animated, verbally and facially expressive, and outgoing. In inclusive settings, however, Colin was exceedingly quiet, shy, hesitant to engage with others, but remained on the fringes of an activity looking on. While in the special education classroom, Colin was a clock-watcher, waiting for the time he was able to transition to his general education classroom and peers. Colin would often verbally express his eagerness to join his peers with typical development. Once he arrived in the general education classroom, he became quiet and passive, rarely smiling or changing his facial expression, even though he had verbally expressed excitement and enthusiasm to his special education teacher just a few minutes before.

A female peer with typical development became friendly with Colin in his general education class, often including him in games and activities in which she was playing. She had a large circle of friends who engaged in a variety of activities. She frequently invited Colin to join them and would often physically guide him into the group. This student was Colin's admission ticket into several activities and social opportunities within recess. Colin rarely approached her to initiate a social interaction or to request inclusion into an activity. He often would stand close to her and wait for her to notice him. In her absence, or if she failed to notice him standing by, he would spend the duration of the recess period alone.

Colin's Social Story™ was written to reflect ways to approach peers and request inclusion into a game of catch or baseball game. His story included scripts of what he might say when seeking to join others in an activity, as a socially appropriate, replacement behavior from merely standing in close physical proximity to a group and waiting to be noticed. The text also included socially appropriate responses he could verbalize to peers when they approached him to play. Lastly, his story discussed the importance of making and maintaining eye contact with others, smiling, and demonstrating verbal responsiveness to others.

Materials

Each participant received an individualized digital Social Story™ constructed using free and readily available software which allowed the "stills" to be developed into a fluid video. The stories incorporated actual photographs of the participants engaging in positive social behaviors, accompanied by brief, descriptive voice over narration. Each Social Story™ video was 30-50 seconds long in accordance with past effective research studies (Alkinj, Pereira, & Santos, 2022). All participants were given the option of narrating their personalized Social Story™. However, all three declined to do so. Therefore, the researcher narrated each story.

Each story followed the standardized structure recommended by Gray and Garand (1993), including descriptive, perspective, directive, and affirmative sentences. For instance, one story depicted a participant watching friends play tag, then joining the game by asking, "Can I play too?" and concluded with affirming statements such as "My friends are happy when I play with them." After viewing their story, participants routinely answered questions as

comprehension checks; research indicates when comprehension increases, so does the effectiveness of the social narrative intervention (Styles, 2011). These stories were uploaded to hand-held, personal devices, allowing. students to view them privately and independently before recess. Headphones ensured confidentiality and reduced environmental distractions. Redacted examples of each participants' individualized stories are included in the Appendix.

Single Case Research Design

A *multiple-baseline design across participants* was used to establish experimental control and observe changes in social behavior over time. This staggered intervention design is employed to determine whether a functional relationship exists between the independent variable (Social Stories intervention) and the dependent variable (appropriate social interactions).

A multiple baseline design contains only two phases for each participant: baseline and intervention. Once participants enter the intervention phase, they continue to receive intervention until the study's conclusion. A functional relationship can be established when differential changes in the dependent variable are noted for each individual participant by systematic introduction of the independent variable by the researcher. A multiple baseline across participants design is highly desirable in single-subject research because a functional relationship can be established *without* withdrawing the intervention or independent variable, as done in an ABAB or reversal design. A maintenance phase can be added once the intervention has ceased.

Data Collection

For the purposes of this study, appropriate social interactions were defined as a response, either verbal or nonverbal, following a peer's comments or initiations within 3-5 seconds, which were contextually appropriate and on topic. This definition reflected a modified version from a model established by Thiemann and Goldstein (2001) and utilized by Delano and Snell (2006) in their seminar work; the Delano and Snell research study has been cited 475 times. Examples of appropriate verbal social interactions included: appropriately commenting on an on-going topic or activity; asking or answering a question; or following up with a related comment, within the context of the given situation. Examples of non-verbal, appropriate social interactions involved gesturing (pointing, nodding, or shaking head).

The data collection method used in the study was momentary time sampling. Momentary time sampling involves a data collection method which takes a larger increment of time, five minutes in this case, and divides the five-minute block of time into smaller, equal intervals (ten seconds). A timer or beeper is set to indicate the end of a ten second interval, in a discreet fashion, with a gentle vibration. Information contained on the data collection form included date and time of observation, name of primary data collector and secondary data collector, as appropriate, location of recess (indoor or outdoor), type of social interaction by code observed, and field notes. Each participant was assigned a color, and the data collection

form was then photocopied upon assigned colored paper, to further ensure the confidentiality of the participants and to assist the data collector in observational sessions.

Each participant was observed individually and on a rotating basis during data collection sessions. Because each participant was in a different grade, the researcher needed to observe three separate recess periods, during differing times and locations. The recess periods overlapped, allowing the researcher to observe the participants in a rotating manner. This rotation ensured the students were not always observed during the same time daily. The resulting data indicated a total number of intervals in which the target behavior was demonstrated, which was then converted into a percentage of observed intervals of appropriate social interactions. These percentages were graphed daily.

Prior to the onset of the study, primary and secondary data collectors were trained using a video, depicting a boy with autism and a sibling engaged in a social situation. This video was approximately 6.5 minutes long and showed two boys playing the card game Uno. The primary and secondary data collectors reviewed the operational definition prior to watching and scoring the video. Additionally, the data collection sheet contained the target behavior and operational definition for reference.

Inter-rater reliability of 80% or higher was required before the data collectors could begin baseline data collection. This training occurred in the special education classroom, immediately following the dismissal of the students at the end of the day. Training of all data collectors took approximately 90 minutes. As is the case in most single-subject research, it was not possible to keep the secondary data collectors "blind" to the dependent or independent variables. The hosting school district was clear in conveying to the staff that assistance in this research study was completely voluntary and optional. No coercive measures, entitlements, or enticements were employed to sway classroom staff members to participate in the research study.

The research study contained three phases: **baseline, intervention, and maintenance**. Each phase is briefly described below. Additionally, the researcher measured the social validity of the study by soliciting input from the adults involved in the study.

During the **baseline phase**, participants engaged in regular recess activities without any intervention. Observers recorded the percentage of social interactions with peers among 10-second intervals. Each participant engaged in a baseline phase during which typical social interactions were recorded.

Following the baseline data collection, the **intervention** was introduced sequentially to each participant. Observations were conducted using 10-second momentary time sampling across 5-minute sessions during indoor or outdoor recess. Interactions were coded as either verbal (e.g., greetings, questions, sharing comments) or non-verbal (e.g., eye contact, gestures, shared activities). Interobserver reliability was assessed regularly, achieving over 90% agreement.

During the **intervention phase**, each participant viewed their personalized digital Social Story™ immediately before recess each day. After viewing, they participated in recess as usual while observers collected behavioral data in ten second intervals using momentary time sampling. Results were coded using the following system, differentiating between verbal and non-verbal behaviors, appropriate and inappropriate.

Verbal:	**Non-verbal**:
Seeking Attention - SA Initiating Comments - IC Initiating Requests - IR Contingent responses - CR Non-appropriate verbal – NA	Appropriate non-verbal - APP Non-appropriate non-verbal - NA

A copy of the data collection sheet is available upon request.

Appropriate implementation of the intervention was determined through a procedural checklist to assess fidelity.

Once consistent increases in social interactions were documented, the **maintenance phase** began. During this phase, participants no longer viewed their social narratives, but observation continued to determine whether behavioral improvements persisted.

Following data collection, teachers, and paraprofessionals, who were familiar with the intervention and provided some form of educational support to participants, completed a **social validity questionnaire**, the Intervention Rating Profile or IRP (Lane et al., 2009). The IRP contains 17 items, rating the benefits of the intervention, and how appropriate it was for use in a school setting. The IRP uses a 7-point Likert scale to respond to each item, ranging from choices of “strongly agree”, to “strongly disagree”. A copy of the IRP is attached hereto as Table 1.

Results

Quantitative analysis of the data revealed consistent and meaningful improvements in participants’ social interaction behaviors following the implementation of the digital Social Story™ intervention. Although the study did not establish a functional relationship between the independent and dependent variables, two of three participants, Allen, and Colin, demonstrated noteworthy increases in the target behavior through the duration of the study.

The findings are presented graphically by individual participant, in Figures 1-6, while also supported by descriptive statistics.

As referenced, results from this investigation were unable to establish a functional relationship between the social narratives intervention and the target behavior of appropriate social interactions. When appropriate social interactions were analyzed collectively, nonverbal and verbal, Allen and Colin demonstrated notable increases in the target behavior from baseline levels. Brandon's socially appropriate interactions were increasing by the

maintenance phase of the study. When examined for effect size, the intervention proved moderately to strongly effective for two of the three participants. The intervention did not prove effective for the remaining participant. All three participants demonstrated appreciable increases in appropriate non-verbal social interactions from baseline levels. However, increases in appropriate verbal social interactions were negligible for all three participants. Individual results will be discussed below.

Participant Outcomes

Brandon: Brandon demonstrated a greater increase in the percentage of nonverbal appropriate social interactions when compared to appropriate verbal social interactions.

Verbal. Brandon did not demonstrate instances of socially appropriate verbal interactions during the baseline phase of this study. During the intervention phase, Brandon's mean percentage of intervals of socially appropriate interactions was 4.4%, with a range from 0-17%. The magnitude of change from baseline to intervention was 4.4%. Brandon did not demonstrate any changes in level between baseline and intervention and required four sessions of intervention to demonstrate an increase in the target behavior. During the maintenance phase, the mean percentage of intervals of socially appropriate verbal interactions was 0, and no change in level. Brandon was not able to demonstrate appropriate verbal social interactions at all during the maintenance phase and the magnitude of change was -4.4%.

Non-verbal. Brandon 's mean percentage of intervals of non-verbal, socially appropriate behavior was 11.4% during baseline with a range from 3-27%. During the intervention phase, Brandon's mean percentage of nonverbal socially appropriate intervals was 12.6%, demonstrating a magnitude of change of 1.2% from baseline to intervention. The range was 0-57%, and the period of latency was four intervention sessions. The level change between baseline and intervention was 3%. The mean of non-verbal socially appropriate interactions during the maintenance phase was 36.8% with a range from 0-80%. The magnitude of change from intervention to maintenance was 24.2%. Brandon demonstrated an immediate level change from intervention to maintenance phases, from 20% to 77% from the last day of intervention to the first day of maintenance.

Brandon did not demonstrate or maintain high levels of socially appropriate interactions in general during this study, but this was even more apparent when comparing verbal and non-verbal interactions. Brandon's socially appropriate verbal interactions over the course of the study were consistently higher in non-verbal nature than verbal. Brandon’s results are graphically depicted in Figures 1 and 2.

Figure 1 – *Percentage of intervals of appropriate social interactions (Brandon)*

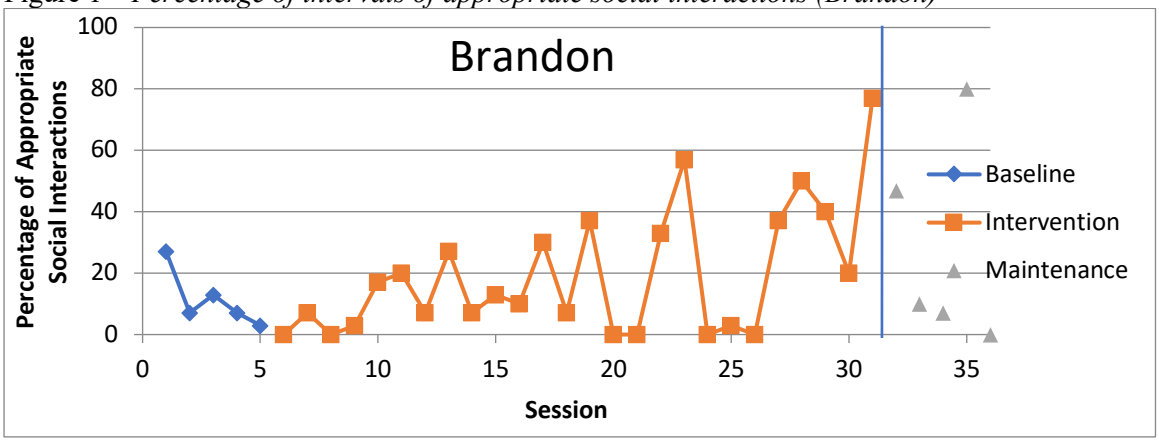
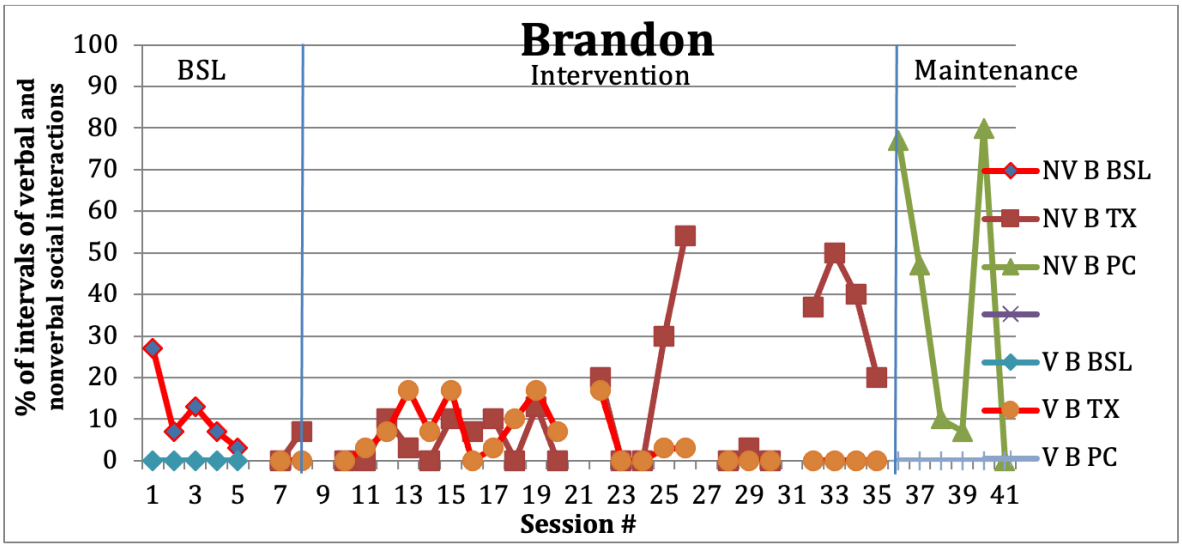


Figure 2 - *Percentage of intervals of verbal and nonverbal appropriate social interactions, by interaction type (Brandon; see below for key)*

Verbal: Seeking Attention - SA Initiating Comments - IC Initiating Requests - IR Contingent responses - CR Non-appropriate verbal – NA	**Non-verbal**: Appropriate non-verbal - APP Non-appropriate non-verbal - NA



Allen

Allen's appropriate social interactions were predominantly non-verbal in nature. This was true in both the intervention and maintenance conditions of this study. Allen's results demonstrate greater increases in nonverbal interactions as opposed to verbal.

Verbal. Allen's average percentage of intervals in which a verbal socially appropriate interaction occurred was .04% during baseline, with a range of 0-7%. During the intervention phase, the mean percentage of intervals of socially appropriate verbal interactions increased to 4.5%, with a range from 0-17%. The magnitude of change between the baseline and intervention phases was 4.1%. Allen demonstrated an immediate increase from the last day of baseline to the first day of intervention, increasing from 3% to 10%. During the maintenance phase, the mean percentage of intervals of socially appropriate verbal interactions were 8%, with a range from 0-3%. The magnitude of change between phases was 3.7% with a small increase from the last day of intervention, 0, to the first day of the maintenance phase, 3%. Allen required one session to demonstrate an increase in the target behavior from the intervention to the maintenance phase.

Nonverbal. Allen's average percentage of intervals in which a socially appropriate non-verbal interaction occurred was 9% during baseline, with a range from 0-7%. During the intervention phase, Allen's mean percentage of intervals of nonverbal socially appropriate interactions was 25.6%, with a range from 0-93%. The magnitude of change between baseline and intervention was 24.7%. Allen demonstrated an increase in the target behavior on the fourth day of intervention, increasing from 0 to 20%, followed by 87% the next session. The mean percentage on appropriate nonverbal social interactions in the maintenance phase was 44.8%, which demonstrated a magnitude of change over the intervention phase by 19.2%. During the maintenance phase, the range of data points was 37% to 87%. There was an immediate level change from intervention to maintenance, as Allen's percentage of intervals of non-verbal socially appropriate interactions increased from 0 on the last day of intervention to 37%, on the first day of the maintenance phase. Allen was never able to reach the same levels of the target behavior demonstrated on the last day of the intervention phase during maintenance.

As noted above, Allen's target behavior of verbal socially appropriate interactions demonstrated a stronger increase in the intervention and maintenance phases than his non-verbal appropriate social interactions. Throughout each phase of this study, the percentage of intervals in Allen's non-verbal social interactions were higher than the percentage of intervals in which a verbal interaction occurred, suggesting greater comfort and fluency in physical forms of social engagement than in spoken exchanges. Allen’s results are graphically depicted in Figures 3 and 4.

Figure 3 – *Percentage of intervals of appropriate social interactions (Allen)*

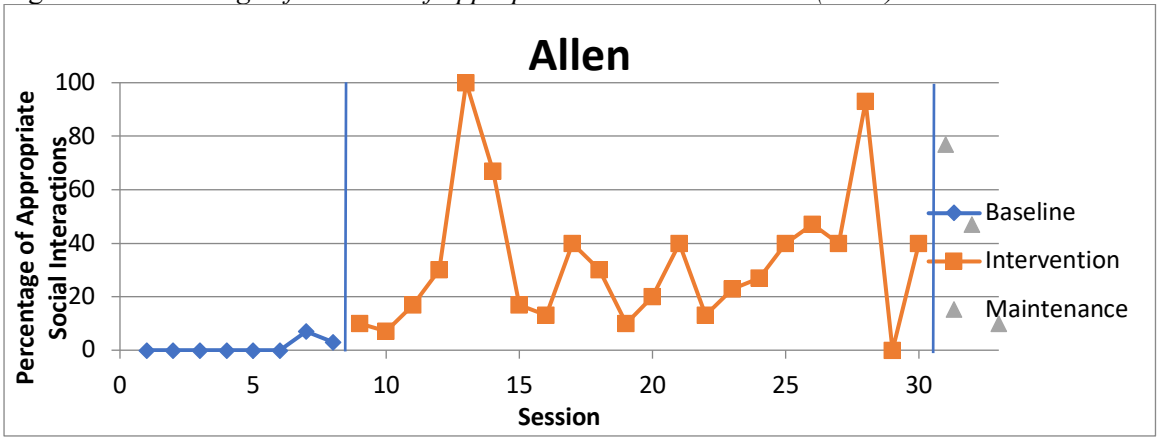
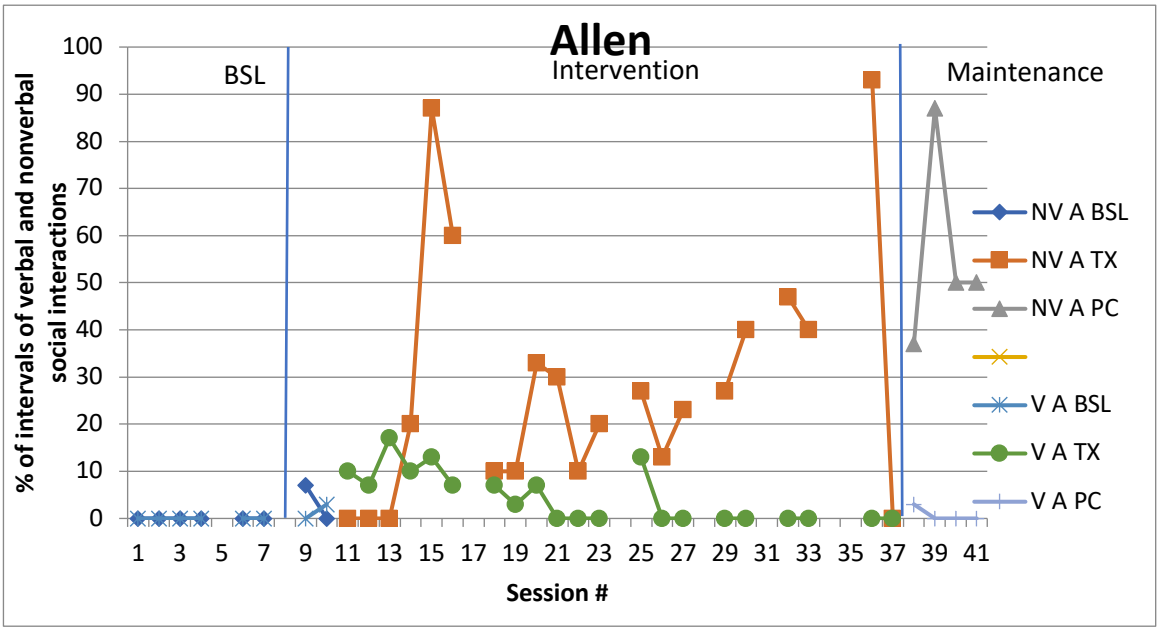


Figure 4 - *Percentage of intervals of verbal and nonverbal appropriate social interactions, by interaction type (Allen; see below for key)*

Verbal:	**Non-verbal**:
Seeking Attention - SA	Appropriate non-verbal - APP
Initiating Comments - IC	Non-appropriate non-verbal - NA
Initiating Requests - IR	
Contingent responses - CR	
Non-appropriate verbal – NA	



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Colin

Colin entered the intervention last, but showed the most notable overall progress, particularly in **nonverbal** social interactions. Colin's non-verbal socially appropriate interactions were stronger than his verbal social interaction. Greater increases in nonverbal appropriate social interactions as compared to verbal interactions were demonstrated.

Verbal. Colin's mean percentage of intervals of verbal socially appropriate interactions was 1.6% during baseline, with a range from 0-7%. Colin's mean percentage of intervals of verbal socially appropriate interactions was 5.3% during intervention. The range of average intervals of verbally appropriate social interactions was 0 to 30%. Colin required one session of intervention to increase his percentage of intervals of verbal socially appropriate interactions from baseline to intervention. The magnitude of change between baseline and intervention for Colin was 3.7%. During the maintenance phase, Colin's average percentage of intervals of verbal socially appropriate interactions were 3.3%, with a range from 0-10%. The last day of intervention and the first day of maintenance were both 0, and Colin required one maintenance session to increase his percentage to 10%. The magnitude of change between intervention and maintenance phases was -2%.

Non-verbal. Colin's mean percentage of intervals of socially appropriate non-verbal interactions were 7.6% during baseline, with a range from 0-20%. Colin's mean percentage of intervals of socially appropriate non-verbal interactions increased to 52.7% during the intervention phase, ranging from a low of 0 to a high of 100%. The magnitude of change between baseline and intervention was 45.1%. Colin required two sessions in intervention to demonstrate an increase in non-verbal social interactions over baseline performance. Colin's mean percentage of intervals of non-verbal socially appropriate interactions during maintenance was 61%, with a range from 30-87%. Colin demonstrated a level change from 17% on the last day of intervention to 67% on the first day of the maintenance phase, for a latency of one maintenance session. Colin's non-verbal, socially appropriate behavior increased throughout each phase of the study. He demonstrated stronger gains in the target behavior through non-verbal interactions than he did through verbal interactions. Colin's results are graphically depicted in Figures 5 and 6.

Figure 5 - *Percentage of intervals of verbal and nonverbal appropriate social interactions, by interaction type (Colin)*

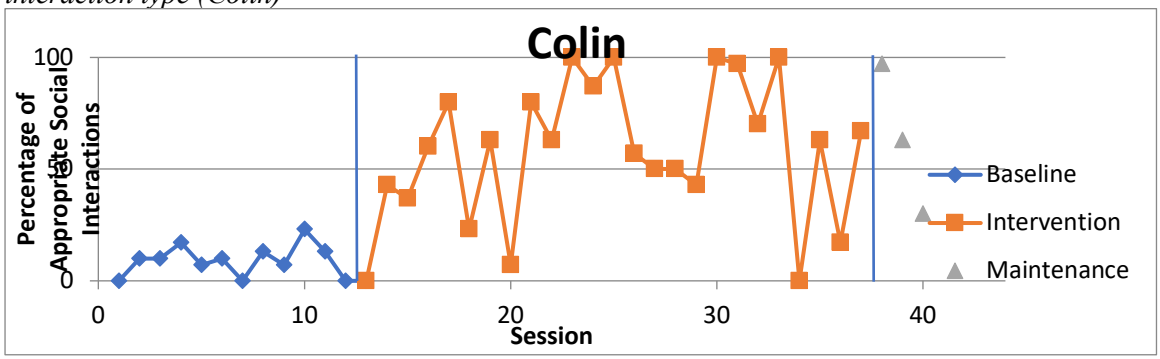

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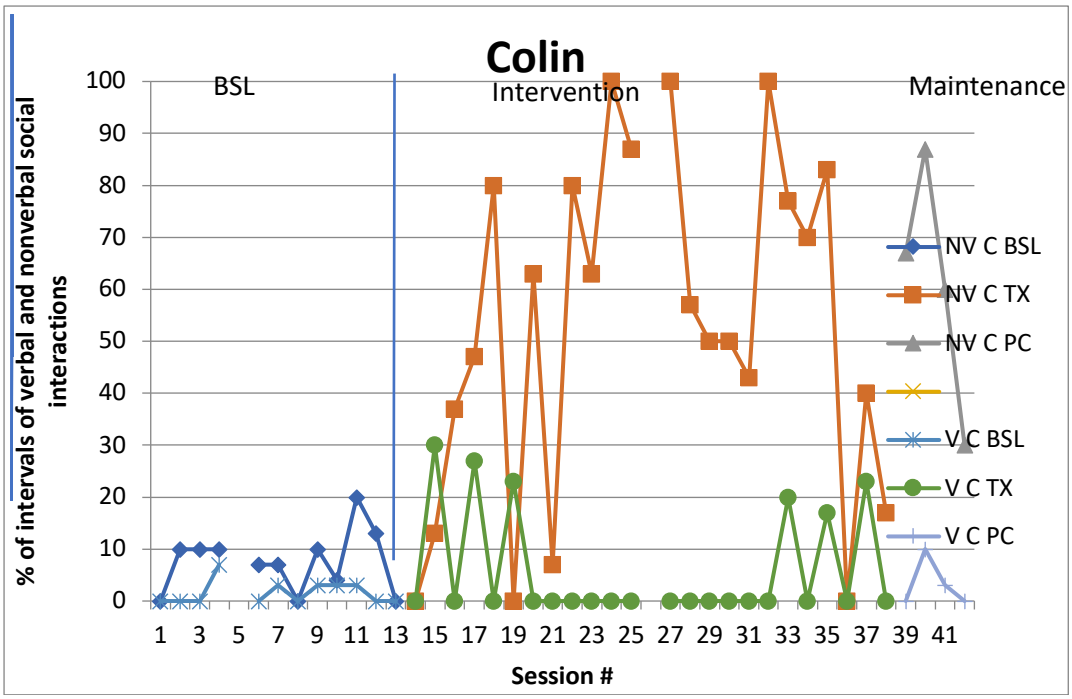
Figure 6 - *Percentage of intervals of verbal and nonverbal appropriate social interactions, by interaction type (Colin; see below for key)*

Verbal:	**Non-verbal**:
Seeking Attention - SA	Appropriate non-verbal - APP
Initiating Comments - IC	Non-appropriate non-verbal - NA
Initiating Requests - IR	
Contingent responses - CR	
Non-appropriate verbal – NA	



Each of the three participants in the present study responded differently when in inclusive settings with typical peers. Even though all had a diagnosis and classification of autism, all were male, and were close in age, individual responses to the intervention varied widely. Allen and Colin possessed stronger communicative abilities than did Brandon and subsequently demonstrated stronger overall results in the present study. Brandon did not demonstrate any appreciable gains from the study, Allen showed moderate gains, and Colin demonstrated the strongest gains. These differences in results remind us of the wide range of abilities children on the autism spectrum possess. Interventions must be sensitive to these differences and carefully selected. While this underscores the importance of evidence-based practices in working with students with autism, to ensure researchers and educators are providing the students with highly effective intervention plans, perhaps Brandon and Allen

needed more support in addition to a social story. Social skills are complex, and these two individuals may have required more direct instruction.

Overall Observations

Prior to intervention, all three participants displayed extremely limited social engagement, spending the majority of recess time in solitary play or parallel activity without verbal or non-verbal interaction with peers. During the baseline phase, the mean percentage of appropriate social interactions across all participants was only **1.2%**. Upon introduction of the individualized digital social narratives, a marked increase in social interaction frequency and quality was observed.

Collectively, the figures depict a strong visual correlation between the onset of the digital Social Story™ intervention and the increase in social interaction behavior across all participants. Visual analysis of the data supports the conclusion that the intervention produced consistent and meaningful changes in social engagement for students with autism spectrum disorder in inclusive school environments.

Overall Trends

When data were aggregated across participants, a distinct and consistent pattern emerged. The combined results show a mean increase from **1.2% during baseline** to **57.9% during intervention**, with maintenance levels remaining above **45%**. The staggered timing of each intervention introduction supports the internal validity of the design, as improvements occurred only after the digital Social Story™ was implemented.

Across all participants, non-verbal interactions, such as gestures, shared activities, and eye contact, demonstrated the most pronounced gains. Verbal interactions also increased, to a lesser extent. This distinction suggests that students may first develop comfort and confidence through non-verbal means before expanding to verbal exchanges.

Social Validity Measures

The social validity of this intervention was established based on the results from the Intervention Rating Profile or IRP (Lane et al., 2009). Teachers' social validity ratings are depicted in Table 1, with all educators rating the intervention as *"highly effective," "practical,"* and *"appropriate for inclusive settings."* The classroom team highlighted the use of the hand-held personal device as particularly beneficial for maintaining students' attention and motivation while minimizing stigma.

Educators who responded to the IRP indicated favorable ratings regarding the feasibility and worthiness of social narratives as viable intervention. The results of the IRP indicate that the educators found the Social Story™ intervention to be socially valid. Overall, the average rating across all three respondents on the IRP was 6.2 out of a possible 7 points, with a range in mean across all responses from 5.3 to 7.0. Results of the teacher and paraprofessional responses for the intervention are represented in Table 1.

Table 1- Intervention Rating Profile
Teacher and paraprofessional responses for Social Story intervention

1(not at all) 2 3 4 (*50/50 neutral*) 5 6 7 (very much)

Item	Mean response	SD of response
1. This would be an acceptable intervention for a school setting.	6.7	.06
2. Most teachers would find this intervention appropriate.	6.7	.06
3. This intervention should prove effective in meeting the purposes.	5.3	1.5
4. I would suggest the use of this intervention to other teachers.	5.7	1.5
5. The intervention is appropriate to meet the school's needs and mission.	6.0	1.7
6. Most teachers would find this intervention suitable for the described purposes and mission.	5.7	1.5
7. I would be willing to use this intervention in the school setting.	7.0	0
8. This intervention would not result in negative side-effects for the students.	7.0	0
9. This intervention would be appropriate for a variety of students.	7.0	0
10. This intervention is consistent with those I have used in school settings.	5.7	1.5
11. The intervention is a fair way to fulfill the intervention purposes.	6.7	.06
12. This intervention plan is reasonable to meet the stated purposes.	7.0	0
13. I like the procedures used in this intervention	6.0	1.7
14. This intervention is a good way to meet the specified purpose.	5.7	1.5
15. The monitoring procedures are manageable.	6.3	1.2
16. The monitoring procedures will give the necessary information to evaluate the plan.	5.3	1.5
17. Overall, this intervention would be beneficial for students.	5.7	1.5
Mean of total responses	6.2 / 7.0	

Aldabas (2019) and Fernandez-Andres, (2019) found that teachers reported that Social Story™ interventions were effective in teaching prosocial skills in academic settings. Additionally, Fernandez-Andres (2019) reported that social narratives were rated with high social validity across all stakeholders, including professionals, family members, and neurodiverse individuals who identified as being on the autism spectrum themselves. Camilleri, Maras, and Brosnan concurred with these findings, in their large study of 2024 (n=856, throughout three datasets) which examined the effectiveness and social validity of Social Stories™. Even when rigorous research establishes an intervention as effective, if educators find the treatment to be time-consuming, or cumbersome to implement in a school setting, the probability of implementing an intervention with fidelity will remain low. In short, social validity is critical for treatment integrity and subjective measurement (Snodgrass, Cook, & Cook, 2023). Consequently, the research to practice gap will be sustained. The educators also reported the Social Story™ was easy to implement, effective, and appropriate for children in academic settings. The educators also commented anecdotally on the ease in which all three participants learned how to access their own story, and their subsequent independence in viewing a tailor-made narrative. The ability to work

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independently is a skill often taught in special education programs and is a valued ability in our communities and places of work.

All the educators surveyed responded they would be willing to use a digital version of a Social Story™ to teach interpersonal skills in the future. Educator investment is a key component of any intervention. Teachers and paraprofessionals must agree that classroom-based practices are a socially valid intervention to use in their classrooms for treatments to be successful for students with autism (McNeill, 2019).

Social narratives are easy and cost effective to produce. With the availability of free software downloads, any teacher or practitioner can create a Social Story™ with little time and money invested. Employing this intervention in a school or home-based setting is a cost-effective endeavor. As evidenced by the present study, little to no training time is needed for participant proficiency in personal device use. Because of the voiceover narration features on the Social Story™, participants could access the story even as non-readers, further reducing the need for adult supervision. Cost effectiveness is an important consideration when assessing the social validity of an intervention, as time and resources in classrooms are valuable commodities.

Discussion

The findings from this study provide compelling evidence that digital social narratives can effectively enhance the social interaction skills of children with ASD in inclusive settings. Each participant showed measurable and sustained improvement, particularly in non-verbal engagement behaviors. This suggests that technology-based narratives can serve as a bridge between awareness and action, translating abstract social concepts into concrete, observable behaviors. The use of hand-held, personal devices, familiar and engaging devices for children, contributed to the intervention's success by making participation self-directed and discreet.

Interpretation of Results

The observed pattern, stronger improvement in non-verbal compared to verbal interactions, aligns with the developmental trajectory of social communication in children with ASD. Non-verbal engagement may function as a foundation upon which more complex verbal behaviors can be built. Additionally, the repetitive and consistent presentation of stories likely reinforced memory and comprehension of social scripts, allowing participants to generalize learned behaviors beyond the viewing sessions. The digital format also reduced cognitive load by pairing visual, auditory, and textual elements, catering to multiple learning modalities.

Educational Implications

From an educational standpoint, these results underscore the potential for integrating technology-enhanced social narratives into daily school routines. Digital social narratives are easily customizable, cost-effective, and compatible with existing classroom technology. Their

discreet nature supports inclusive implementation, avoiding stigmatization and enabling students to receive this intervention privately. Teachers and aides reported that students looked forward to viewing their stories and often initiated playback independently, highlighting intrinsic motivation, a critical factor in sustaining behavioral change.

Limitations and Future Directions

Despite these potentially promising results, several limitations warrant consideration. Although the present study observed participants in the inclusive setting of recess with general education peers, the intervention itself was implemented in the special classroom. Practitioners should introduce interventions in the inclusive setting whenever possible.

The three participants in this study were in different grades and of differing ages, which could limit the effects of this intervention. Brandon, the youngest participant in the study, also demonstrated the smallest gains, while the two older participants showed an increase in social interactions throughout the course of the study. The older students had more exposure to their peer groups, as they had been in school together for 3-4 years, while Brandon was in his first year at this school and with these peers. Due to his younger age, it is also possible that Brandon had not reached the level of maturity necessary to interact appropriately with peers, especially given his diagnosis of ASD and social-emotional delays. It is also possible that Allen and Colin's peers, who were older than the peers of Brandon, may have been more mature and well-versed in insisting that the participating students interact with them and persisting until they did. Brandon also acquired language later developmentally; additionally, the language spoken in his home (first exposure) was not English.

It is also important to note the three participants spent varying amounts of time in inclusive settings outside of recess. For example, of the three, Brandon spent the least amount of his school day in a general education, inclusive classroom, and demonstrated the smallest gains as a result of the intervention. A student included full-time in the general education classroom may have demonstrated more favorable results, as peers may regard him as an equal in the classroom, as opposed to a part-time presence.

The Social Story™ intervention required the child to understand the narrative of the story. Although the participants were routinely asked comprehension questions, it was still possible for them to answer the questions correctly, but not have a strong, internalized understanding of what their story was directing them to do in a social situation.

The small sample size limits the generalizability of findings, and the absence of a control group restricts the ability to establish causal inference. Moreover, observations were limited to recess, leaving questions about generalization to academic contexts or home environments. While interobserver reliability was high, potential bias in subjective behavior coding cannot be entirely ruled out. Future studies should expand sample sizes, employ randomized controlled trials, and examine long-term effects. Comparative research contrasting *digital* and *paper-based* social narratives could also clarify relative efficacy, and the inclusion of peer-mediated components may enhance reciprocal social outcomes.

Conclusion

This study contributes to the growing body of research demonstrating the value of technology-based interventions for students with ASD. Digital social narratives not only replicate the established benefits of traditional narrative-based instruction but expand them through accessibility, personalization, and motivational appeal. As schools continue to prioritize inclusive education, interventions that are both empirically supported and adaptable to mainstream classrooms are increasingly essential. The findings affirm that technology, when purposefully integrated, can be a powerful vehicle for promoting social connection, communication, and participation among children with autism.

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