The Journal of Special Education Apprenticeship

4-1-2021

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Using Social Stories™ on the iPad to improve classroom behavior for students with Autism Spectrum Disorder: A pilot study

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Reviews of the literature have confirmed that Social Stories™ can be an effective intervention for individuals with ASD. Recently, researchers have begun to investigate the presentation of Social Stories™ using technology, with results suggesting that Social Stories™ presented through technology are a promising avenue for practice and research.

In this study, a multiple baseline across participants design was used with four male 7-9 year old students with ASD to determine whether an iPad-based Social Story™ would decrease the number of teacher redirects required by the participants in order to attend to a group lesson. Effect sizes were calculated using PND, PEM, and Tau-U. Results of these analyses generally indicated that overall that the intervention was effective, with the exception of PND for three participants; all other effect sizes indicate an effective or very effective treatment for all participants. Results indicate that iPad-based Social Stories™ can help decreasing the number of redirects required for students with ASD to attend to a group lesson.

Keywords: autism spectrum disorder, Social Stories™, technology, iPads, behavior

Autism Spectrum Disorder (ASD) is a developmental disability affecting approximately one in 68 children in the United States of America, according to recent estimates (Centers for Disease Control and Prevention [CDC], 2014). Individuals with ASD have deficits in social and communication skills, as well as exhibit repetitive and stereotyped behaviors and interests and hyposensitivity or hypersensitivity when processing sensory stimuli (American Psychological Association [APA], 2013). Due to the impairments displayed by children with ASD, they may have difficulty regulating their behavior in the classroom and may engage

in challenging and disruptive behavior (Machalicek, O'Reilly, Beretvas, Sigafoos, & Lancioni, 2007). These behaviors can interfere with their learning and may cause them to be unable to participate in the general education classroom setting.

Since there is currently a movement towards inclusion for students with ASD (Callahan, Henson, & Cowan, 2008), interventions have been developed in order to help reduce these challenging behaviors in the classroom. One such intervention is Social Stories™, an evidence-based intervention created by Carol Gray with the goal of decreasing inappropriate behaviors and improving social skills in individuals with ASD. Social Stories™ are individualized narratives created with the goal of relaying accurate information about a social situation that will then increase the individual's understanding of the situation, and therefore improve his or her behavior (Gray, 1993). These narratives describe the social situation that is challenging to the individual and breaks it down into steps that are easy to understand. The Social Story™ also includes relevant social cues and information about the internal states of others to teach the child about others' perspectives.

The theory behind Social Stories™ is based on research involving social cognition, which is how individuals think about, process, and understand social situations and information (Gray & Garand, 1993). Such research indicates that students with ASD's

social deficits may be due to their difficulties accessing appropriate social information, rather than their difficulties understanding social situations or difficulties in responding to the information in an appropriate manner (Gray & Garand, 1993). Social Stories™ are supposed to make the appropriate social information accessible to the individual by stating the components of the expected behavior in a clear and direct manner so that the individual can understand and respond appropriately.

In order to facilitate a clear understanding of the social situation, all sentences in these stories are short and direct. There are three main types of sentences that should be used in Social Stories™ (Gray & Garand, 1993). The first type is descriptive sentences. These sentences describe the social situation, including the setting, and who and what objects may be involved. The second type, directive statements, tell the individual with ASD the appropriate way to behave in the situation, typically by using "I" statements. It is suggested that these directive statements are presented in a positive way and describe what to do instead of what not to do. Lastly, the third type of sentence is perspective sentences, which describe the perspective or internal state of others who are involved in the social scenario. It is especially important to include perspective statements, as a plethora of research suggests that individuals with ASD have deficits in understanding theory of mind,

the understanding that others may have perspectives, thoughts, emotions, and ideas that are different than one's own (e.g., Baron-Cohen, Leslie, & Frith, 1985; Pino et al., 2017).

Overall, Social Stories™ provide much useful and relevant social-cognitive information to individuals with ASD that directly supports areas that are seen to be deficits in some of these individuals. Social Stories™ have become a common intervention tool used in classrooms to improve the behavior of students with ASD because they are an intervention that is cheap to implement, little training is required, and educators tend to note a positive change in behavior as a result of the intervention (Reynhout & Carter, 2009).

Recent reviews of the literature have confirmed previous findings that Social Stories™ can be an effective intervention for individuals with ASD and should be considered an evidence-based practice (Mayton, Menendez, Wheeler, Carter, & Chitiyo, 2013). Meta-analyses have concluded that Social Stories™ overall are mildly effective at improving behavior (e.g., Reynhout & Carter, 2011). They have been found to be more effective when combined with other evidence-based practices such as video modeling (e.g., Kagohara, Achmadi, et al., 2013), and prompting (e.g., Crozier & Tincani, 2005).

Over time researchers have begun to investigate the presentation of Social Stories™ using technology, another

evidence-based practice for individual with ASD (Wong et al., 2014). Examples include Power Point (e.g., Kagohara, Achmadi, et al., 2013), computer 2D animation (Jeekratok, Chancholar, & Murphy, 2014), and tablets (e.g., Johnson & Bree, 2014; O'Handley, Radley, & Whipple, 2015). Overall, these results suggest that Social Stories™ presented through technology are a promising avenue for Social Story™ intervention research and for practice. Specifically, it has been theorized that Social Stories™ presented through technology may be even more successful than other methods for presenting Social Stories™ since technology appears to be more engaging, especially for individuals with ASD (Padilla & Pierson, 2015).

The purpose of the current study is to expand the literature on an iPad-based Social Stories™ and to determine if these individualized Social Stories™ are effective at improving classroom behaviors of students with ASD. Specifically, this study examined whether an iPad-based Social Story™ intervention would decrease the number of teacher or teacher assistant redirects required by the participants in order to attend to a group lesson.

Methods
Participants
Participants in this study were four male 7-9-year-old students with ASD in a special education classroom for students with communication delays and behavioral challenges in a suburban elementary school in

New York. The students were selected because they exhibited inappropriate behaviors in the classroom that impeded their ability to attend to a group lesson and the teacher believed they could benefit from a Social Story™ intervention. Parental consent was obtained for all participants. See Table 1 for participant description.

Table 1
Participant characteristics

	Age	Services received	Testing data
Billy	8 years 8 months	Special education services; ST (3I, 4G); OT (1I, 1G).	Test of Nonverbal Intelligence, 4th edition (TONI– 4) SS = 79; Expressive One-Word Picture Vocabulary Test, 4th edition (EOWPVT-4) SS = 72; Behavior Assessment System for Children, Second Edition (BASC-2) = Clinically Significant
Eddie	8 years, 11 months	Special education services; ST (3I, 4G); PT (2G); OT (1G)	EOWPVT-4 Standard Score <55, Adaptive Behavior Assessment System-3 (ABAS-3 Composite Score = 87; Test of Nonverbal Intelligence – 4 Percentile rank = 2nd
Sasha	7 years 6 months	Special education services; ST (3I, 4G); OT (1G); 1:1 aide	EOWPVT-4= Standard Score <55; BASC C) Behavioral symptoms T score = 82, Learning Problems T score = 70, Social Skills T score = 34
Nikko	8 years 4 months	Special education services; ST (3I,4G/6day cycle); OT (2I,1G/6 day cycle); PT (1G); shared aide	Mullen Scales of Early Learning Expressive Language, Age Equivalent = 31 months; Receptive Language, Age Equivalent = 27 months; Vineland Adaptive Behavior Scales Socialization Standard Score = 57, Communication Standard Score = 44

Key: I = Individual, G = Group; ST = speech therapy; OT – occupational therapy; PT = physical therapy; SS = standard score

Materials

The application "Social Stories™ Creator and Library for Preschool, Autism, and Special Needs" was used in order to create the personalized Social Stories™

and was presented on an Apple iPad. Photographs of the students were taken in their classroom using the iPad camera, and the classroom teacher, using the iPad microphone, recorded audio of the text of the Social Stories™. Each Social Story™ was created with input of the classroom teacher following the guidelines of Gray (1993).

Design and Procedure

The experimental design of this study is a single-case multiple baseline design across participants with two phases: (1) Baseline, in which each student was observed prior to instruction and the number of redirects by the teacher or teacher assistant was recorded. The baseline phase continued until each participant had a stable baseline, or a baseline trending against the desired direction, with at least five data points. (2) Intervention Phase. After each participant's baseline has reached stability, the first participant was randomly chosen to begin the intervention. Immediately before the group lesson, the participant was presented with the Social Story™ on the iPad and was prompted to watch and listen to it. During the group lesson that followed the first author observed the participant and recorded the number of redirects by the teacher or teacher assistant. After three sessions, the intervention began for a randomly selected second participant, who also watched and listened to the Social Story™ immediately before the group lesson began; this procedure continued until all participants received the intervention. All work was carried out in accordance with the ethical standards of the Institutional Review Board at the authors' university.

Measures

The dependent variable measured in this study was the number of redirects by the teacher or teacher assistant during a group lesson. A redirect was defined as when the student was off-task and the teacher or teacher assistant verbally or nonverbally (e.g., point, touch) reminds the student to attend to the group lesson or the work being done during the group lesson.

Data Analysis

The data plan was as follows: first, conduct visual analyses to determine the level, trend and stability of the data; second, if visual analyses indicated a potential functional relationship, calculate effect sizes using three different nonoverlap indices. First, Percent of Nonoverlapping Data (PND; Scruggs, Mastropieri, & Castro, 1987), which requires determining the highest data point in the baseline phase and calculating the percentage of data points in the intervention phase that are larger than that highest data point, was used. According to Scruggs and Mastropieri (1998), PND scores above 90 are indications for very effective treatments, scores from 70 to 90 represent effective interventions, scores from 50 to 70 are questionable, and scores below 50 are ineffective. This method is commonly used in single-case design studies; however, it does

have limitations. Specifically, it is susceptible to outliers, meaning that one data point in baseline that is much higher or lower than the rest can greatly impact the outcome (Parker, Hagan-Burke, & Vannest, 2007).

Consequently, two other non-overlap indices were also used: Percent Exceeding Median Data (PEM; Ma, 2006), which requires determining the median point of the baseline phase and then calculating the percentage of points in the intervention phase that are larger than the median of the baseline phase; and Tau-U (Parker, Vannest, Davis, & Sauber, 2011), in which each baseline data point is paired with each intervention datum point to determine whether the pairs are positive if there is an increase, negative if there is a decrease, or tied, if they are the same.

Results

Results from the visual analyses indicate that all four participants lacked stability during baseline, following Neuman and McCormick's (1995) standard for baseline stability, with only 29%, 50%, 53% and 5% of the data points, respectively, falling within 15% of the mean. However, this was not a concern because each of the participants demonstrated an increasing trend, which was opposite of the desired direction (i.e., a decrease in number of redirects).

During the intervention phase, all participants' behavior decreased in level with no clear trend. Less variability was noted in Billy, Nikko, and Sasha, with about 50%, 45%, and 40%, respectively, of the data points falling with 15% of the mean. None of Eddie's data points fell within the 15% mean. The effect of the intervention was seen immediately, with the number of redirects dropping from 10 to 3 for Billy, from 14 to 1 for Nikko, from 10 to 4 for Eddie, and from 13 to 0 for Sasha. There was little overlap between the baseline phase and intervention phase for all participants (see Figure 1).
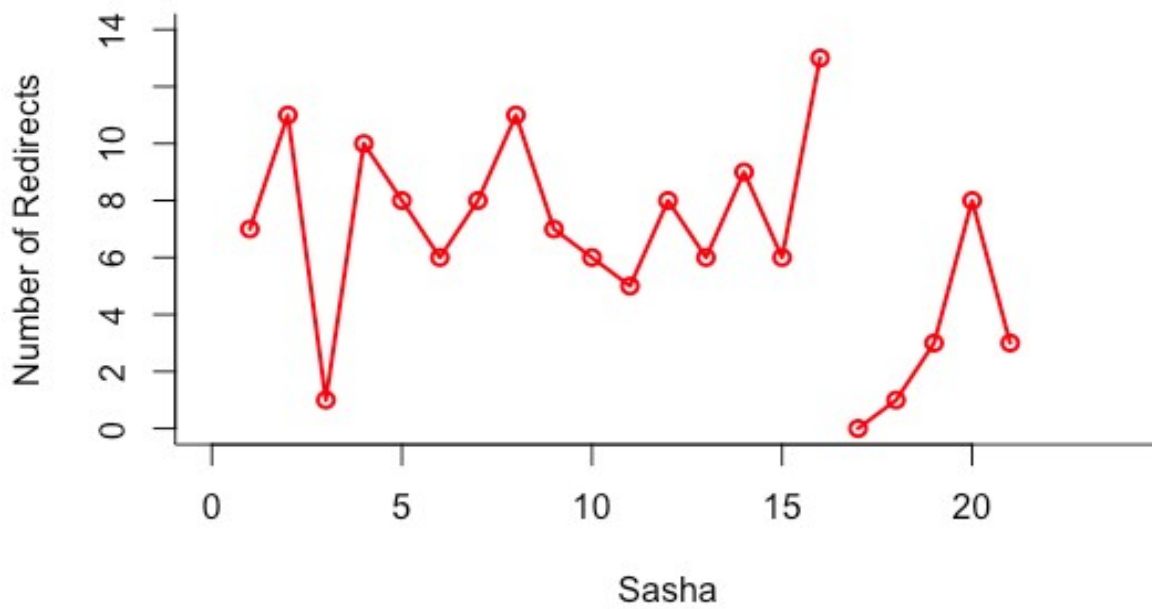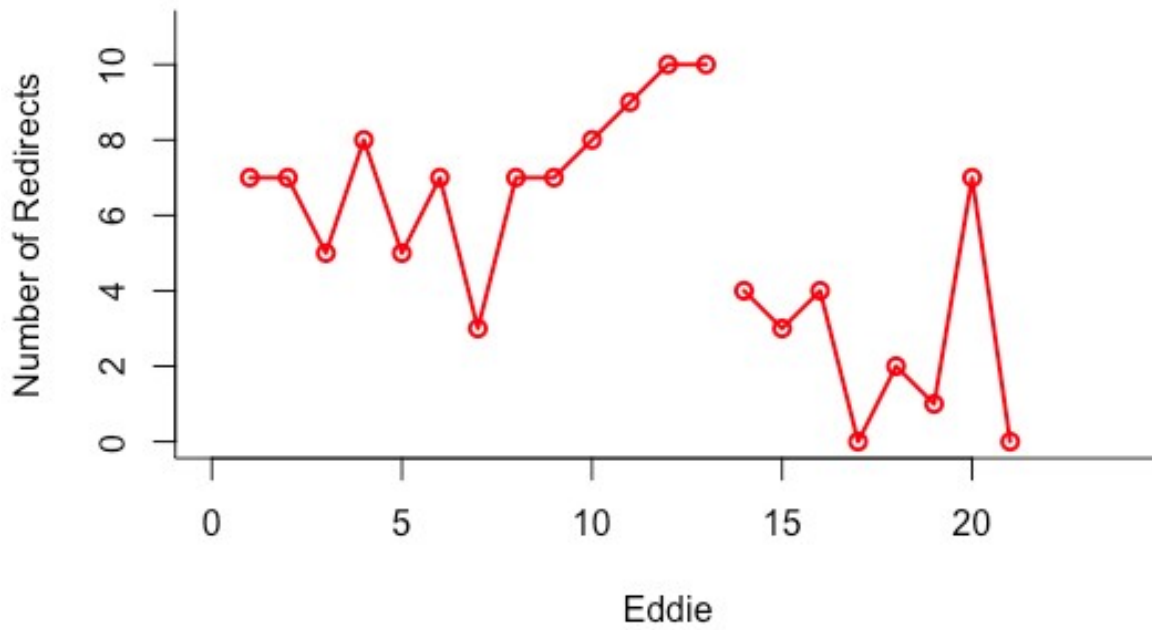
Number of Redirects per Session

Bill

Nikko

Eddie

Sasha
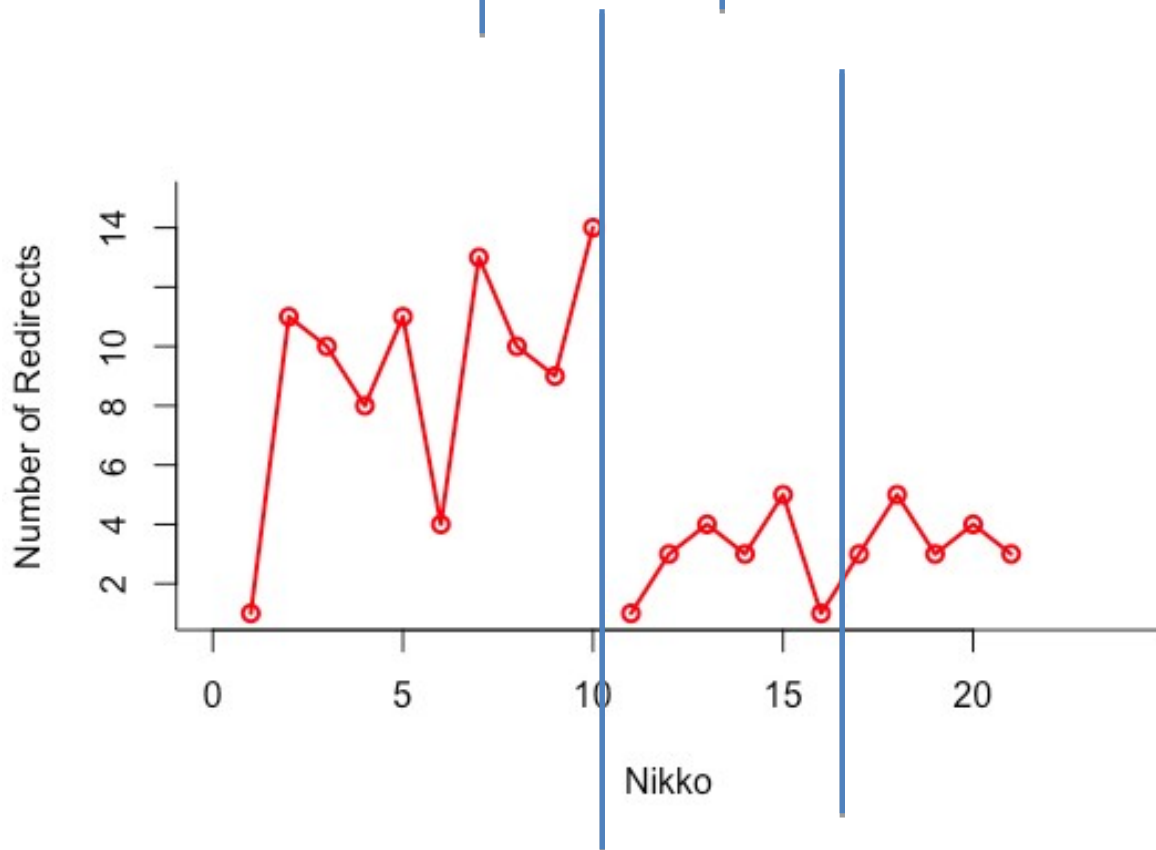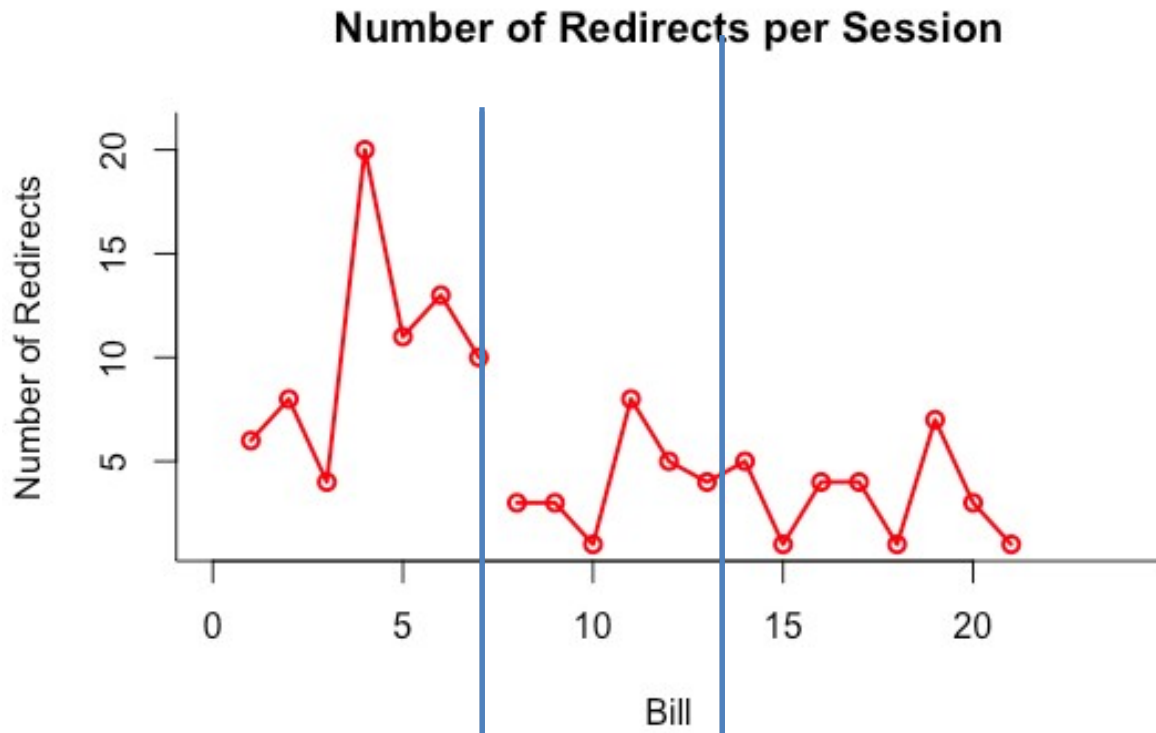
Figure 1
Number of redirects per session

Based on the visual analysis, we concluded that there was evidence for a functional relationship between independent and dependent variable; therefore, effect sizes were calculated using PND, PEM, and Tau-U (See Table 2). Results from PEM and Tau-U indicated that overall the intervention was effective or very effective for all four participants. PND was found to be questionable for Billy and ineffective for all other participants. This was not surprising, given the effects of outliers on PND, and that fact that both Nikko and Sasha had notable outliers in baseline (refer to Figure 1).

Table 2
Non-overlap indices for all participants

	Billy	Nikko	Eddie	Sasha
PND	50%	0%	43%	20%
PEM	100%	100%	86%	80%
Tau-U	83%	76%	84%	70%

Discussion and Conclusions

Results from this study indicate that the use of a Social Stories™ app presented via an iPad may help reduce the number of redirects required for students with ASD to attend to a small group lesson. This supports previous research that technology may be a worthy vehicle through which to present Social Stories™ to students with ASD (Padilla & Pierson, 2015). It extends the findings of researchers such as Vandermeer, Beamish, Milford, and Lang (2013), who found that iPad-based Social Stories™ improved on-task behavior for pre-school aged children, to elementary school-aged students with ASD.

Anecdotally, the classroom teacher reported that all students improved their ability to attend to a group lesson after receiving the intervention. She described the story as helpful in providing the students with "an expectation of what their body should look like during the group lessons," and that students would often refer to those expectations throughout the lesson. This supports Gray and Garand's (1993) assertion that because Social Stories™ clearly state the expected behavior, individuals can respond appropriately.

This study provides further evidence to support the rationale behind using Social Stories™ described by Gray and Garand (1993), suggesting that the social impairments observed in individuals with ASD are due to difficulties accessing relevant social information for the situation, rather than difficulties engaging in or understanding appropriate social behaviors. The students, particularly Billy, Sasha and Nikko, began requesting a break when they became overwhelmed, rather

than calling out or engaging in physical behaviors. After the break, each was able to attend to the group lesson. Essentially, the iPad-presented Social Story™ gave the participants a new strategy of using a replacement behavior (i.e. requesting a break) when they became overwhelmed, which is the ultimate goal of Social Stories™ (Gray, 1993).

Implications

Results of this study have several promising implications for teachers and other practitioners. First, the use of an iPad-based Social Story™ may be less socially stigmatizing than using a paper copy of a social story, because iPads and other such technology use has become ubiquitous for people of all ages and ability levels (Kagohara, Van Der Meer, et al., 2013). iPads are also very popular and readily available, so many practitioners and families will already have access (King, Thomeczek, Voreis, & Scott, 2014).

Once the device is purchased, it can be relatively inexpensive to access many programs. The app used in this study, Social Stories™ Creator and Library for Preschool, Autism, and Special Needs, was selected because it is free to use on all iOS systems, so cost will not be a barrier for practitioners wanting to use the stories. Stories could be personalized, so student customization can occur easily. Additionally, the stories could be shared with other users; therefore, if the student's family has access to an iOS device they may use the same stories at home and in the classroom. This is an excellent way to promote a home-school partnership, and work on generalization for students with ASD.

For one of the students (Eddie), the iPad did occasionally pose as a distraction. Eddie was often given the iPad as a reinforcer, so he had more difficulty focusing on the Social Story™. On a few occasions, he even became angry and refused to watch the story. Therefore, practitioners should consider that students with ASD, who often have difficulty generalizing, may have a hard time using the iPad in a different context.

Limitations and Future Research

As with all single case design research, the limited number of participants is a limitation in terms of generalization of the results. The participants in this study may not be representative of the larger population of children with ASD; therefore, future researchers should replicate the study with larger populations to determine generalizability. Another limitation is that the study was conducted in a self-contained special education classroom. With more students with ASD being included in general education classrooms (Callahan, Henson, & Cowan, 2008), future researchers may wish to conduct studies within a general education classroom setting. Additionally, generalization and maintenance probes were unable to be collected. We therefore could not determine whether post-test gains were

maintained over time, or whether the strategy was transferred to other settings or individuals. These limitations should be explored, as research in maintenance and generalization for students with ASD has been inconsistent. Finally, it is difficult to determine whether the Social Story™ alone would have had the same effects on the students' behavior if it was not presented via an iPad. Therefore, research comparing the two (i.e., paper-based vs iPad based Social Stories™) should be explored. Despite the limitations, this study contributes to a growing field of research supporting the use of technology-based Social Stories™ for students with ASD.

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