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Musically Adapted Social Stories to Modify Behaviors in Students with Autism: Four Case Studies

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The purpose of the present study was to investigate the effect of a musical presentation of social story information on the behaviors of students with autism. Social stories are a means of incorporating an individual with autism's propensity toward visual learning with educationally necessary behavior modifications. Participants in the study were four first- and second-grade students with a primary diagnosis of autism attending an elementary school in eastern Iowa. A unique social story was created for each student that addressed a current behavioral goal. Subsequently, original music was composed using the text of the social story as lyrics. The independent variable for this study was one of three treatment conditions: baseline (A); reading the story (B); and singing the story (C). The reading and singing versions of the social stories were alternately presented to the students using the counterbalanced treatment order ABAC/ACAB. The dependent variable was the frequency with which the target behavior occurred under each condition of the independent variable. Data were collected for a period of 1 hour following presentation of the social story. Results from all four cases indicated that both the reading condition (B) and the singing condition (C) were significantly ($p < .05$) more effective in reducing the target behavior than the no-contact control condition (A). The singing condition was significantly more effective than the reading condition only in Case Study III. For the remaining case studies, the mean frequency of the target behavior was smaller during the singing condition, but not significantly so. These results suggested that the use of a musically adapted version of social stories is an effective and viable treatment option for modifying behaviors with this population.

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According to the Diagnostic and Statistical Manual of Mental Disorders (4th ed.), autism affects between two and five individuals per 10,000 (American Psychiatric Association, 1994). As professionals become more familiar with the disorder, the rate of incidence in the schools increases annually as more and more children are diagnosed somewhere on the autism spectrum. Since the implementation of Public Law 94-142 and its subsequent reauthorization as PL 101-476, the practice of inclusion in the public schools has created a new demand for the production of innovative techniques and interventions for students with autism. These approaches, when effective, must enable the student to function as a fully participatory member of their same-aged class of nondisabled peers.

Autism is comprised of three main diagnostic categories. Individuals with autism display communication impairments, which may include a delay in or absence of the acquisition of language skills, difficulty initiating or sustaining conversational speech, and/or a lack of developmentally appropriate make-believe or imitative play skills. Behaviors, interests, and activities may also be limited or repetitive. These behaviors may include an intensely focused and enduring interest in a specific object or topic, difficulties dealing with nonconformity to established routines, stereotypical motor mannerisms, or perseverant fixation on parts of objects. The final category includes impairments in social interaction, which includes lack of nonverbal behaviors, peer relationships, and emotional reciprocity (American Psychiatric Association, 1994; World Health Organization, 1994).

From the various deficits mentioned in the definitions above, the social development area may be considered the most difficult to overcome. Students with autism frequently display difficulties when developing peer or parent relationships. During childhood, there tends to be a lack of interest in forming these relationships. In adolescence, the desire to initiate social relationships is present, but the requisite social skills are generally absent. Frustration and lowered self-esteem may result from a student's inability to forge satisfying peer relationships, and from their inability to understand social protocols.

The lack of social understanding may be attributed to the child's inability to understand the emotions and perceptions of the individuals with whom they are trying to interact. Nonverbal commu-

nication, such as posturing, eye contact, facial affect, and tone of voice, may be elusive concepts to the student with autism. The inability to incorporate this information results in a marked lack of social understanding. Even if the students are aware of nonverbal aspects of communication, they may be unable to integrate or interpret the various components in a way that provides them with an accurate assessment of the situation (Baron-Cohen & Howlin, 1993; Baron-Cohen, Leslie, & Frith, 1985; Baron-Cohen, Leslie, & Frith, 1986).

Social skill deficits typically encompass all areas of social interaction and are pervasive throughout the lifespan. Many skills developed naturally by typically developing children may be deficient or absent in children with autism. These individuals may be unable to interpret nonverbal social and emotional cues from others, or to recognize emotional states in themselves. This may lead to diminished conversational reciprocity, as the child may be unable to decipher cues of boredom in others when the child dominates the conversation with perseverant talk regarding their area of interest (Howlin, 1986).

This lack of social reciprocity may also lead to a lack of developed peer relationships. Sasso, Garrison-Harrell, McMahon, and Peck (1998) related deficits of peer relationships to the reinforcement that the student receives from their environment. Misread or unrecognized social cues result in aberrant responses. These reactions are met with disapproval from peers. Consequently, the student with autism may be less likely to attempt social interactions in the future. Despite the extensive deficits, social skills can be improved using a number of techniques that have been developed.

In remediating the social skills of students with autism, it is necessary to provide them with information about the environment and social concepts that they are unable to ascertain on their own. Among these concepts are the interpretations of clichés, instructions on how to act in a particular situation, and predictions of how the child's words or actions might impact others. Grandin (1995) noted that individuals with autism tend to be visual learners, and that information imparted verbally may be totally ineffective. This observation implies that merely telling a child how to act or verbally explaining a situation may not provide the necessary information to encourage improved social interaction.

Based on this learning style preference, a visually based system of

delivering social information, termed "social stories," was first developed and described by Carol Gray in 1993 (Gray & Garrand, 1993). As defined by Gray:

> A social story is a short story that adheres to a specific format and guidelines to objectively describe a person, skill, event, concept, or social situation. The goal of a social story is to share relevant information. This information often includes (but is not limited to) *where* and *when* a situation takes place, *who* is involved, *what* is occurring, and *why* (Gray, 1998a, p. 171).

Social stories are individualized for each student's abilities and interests, and created to fit a given situation. Social stories may be presented as solely printed words, words and pictures, or may be audio or video taped for a student. Each story is individually constructed for a specific student and objective. The stories consist of a prescribed ratio of four different sentence types: descriptive, directive, perspective, and control, which are used to describe a given situation and provide instructions on how best to respond (Earles, Carlson, & Bock, 1998). The technique has been used with students labeled as having at least trainable mental impairment, and who have basic language skills (Gray & Garrand, 1993), students with high-functioning autism or Asperger syndrome (Gray, 1998a; Simpson & Myles, 1998), and lower functioning students with autism (Earles et al., 1998; Kuttler, Myles, & Carlson, 1998). Although the technique is somewhat new, it has already received widespread support and anecdotal reports of efficacy, as well as some research-based accounts.

The research focusing on this technique is limited but promising. In the first such study, social stories were developed for an 11-year old girl with autism. The target of the first story was to increase appropriate greeting behavior, which included increased verbal greetings and decreased aggression and inappropriate touching. Data from 9 days of both baseline and treatment indicated that appropriate greetings were increased from 7% to 74%, aggression was reduced from 9% to 0%, and inappropriate touching was reduced from 82% to 26%. Part two of the study involved two 7-year old boys. Target behaviors for both subjects included sharing, parallel play, aggression, and grabbing. Data for the first boy showed a decrease in aggression (30% to 6%), increase in parallel play (80% to 94%), decrease in screaming (100% to 56%), and increase in shar-

ing (0% to 22%). Data for the second boy were similar, most notably showing an increase in sharing from 0% to 35%, and a decrease in grabbing from 100% to 35%. These notable results were achieved with students who have moderate to severe levels of autism, despite Gray and Garrand's (1993) initial recommendation that they be used primarily with higher functioning individuals (Swaggart et al., 1995).

In the other study of this technique, Kuttler et al. (1998) implemented a social story program with a 12-year old boy with autism, Fragile X syndrome, and intermittent explosive disorder. The boy exhibited frequent tantrums during work and lunchtime. Data showed a marked decline in tantrum behaviors in both environments during social story intervention. While only two studies of this nature exist, results are highly encouraging. Continued investigation of this technique will provide further support for its use and greater understanding of social learning in autism.

The story may be presented in a manner that allows the student the greatest amount of concentration and can be read to the student if they are unable. For nonreaders desiring independence, the story may be recorded onto a cassette tape with a bell to indicate page turns. The student may then listen to the tape while following along in the book. Gray (1994) also noted that the pages of the book might be videotaped for children who prefer watching television. Having the student share their story with relevant individuals is encouraged (Gray, 1994, 1998a). This not only provides an additional opportunity for social interaction, but also allows the student with autism and their nondisabled peers to have compatible social information. While many students will respond to the intervention in a positive manner, some may require supplementary reinforcers. Simpson (1993) suggested an evaluation system that allows the child to receive some form of social reinforcement for social story compliance.

The exact method for creating social stories has been described in detail. It is because of this detail that replicable research is possible, and that one technique is used successfully across many individual cases. Social stories consist of four basic sentence types:

1. *Descriptive sentences* objectively define where a situation occurs, who is involved, what they are doing, and why.
2. *Perspective sentences* are statements that describe a person's inter-

nal states. Perspective sentences may simply describe a physical state or desire. Perspective sentences frequently describe another person's thoughts, feelings, or beliefs and motivations.
3. *Directive sentences* are statements that directly define what is expected as a response to a given cue or situation.
4. *Control sentences* are statements written by a student to identify strategies the student may use to recall the information in a social story, reassure him or herself, or define his or her own response (Gray, 1998a, pp. 178–179).

Social stories consist primarily of descriptive and perspective sentences since the primary goal of the story is to provide information rather than instructions. Gray (1994, 1997, 1998b) noted that the most frequent mistake in writing social stories is the utilization of too many directive statements so that the story becomes nothing more than a rigid set of rules that the student is expected to follow. This precludes the children from generating their own independent reactions to a given situation. Directive sentences should also take on positive, provisional characteristics. Phrases such as "I will try to . . . ," "I can try . . . ," and "I will work on . . ." are preferred over more inflexible statements such as "I will . . . ." Statements such as "always" should be avoided in favor of "usually" or "sometimes." Gray (1997) developed what she termed the social story ratio, which can be used as a guideline for using proper proportions of each of the sentence types (p. 5).

$$\frac{\text{0 – 1 directive or control sentences}}{\text{2 – 5 descriptive and/or perspective statements}}$$

Swaggart et al. (1995) outlined 10 steps involved in producing, implementing, and evaluating a social story program:

1. Identify a target behavior or problem situation for social-story intervention.
2. Define target behaviors for data collection.
3. Collect baseline data on the target social behavior.
4. Write a short social story using descriptive, directive, perspective, and control sentences.
5. Place one to three sentences on each page.

6. Use photographs, hand-drawn pictures, or pictorial icons.
7. Read the social story to the student and model the desired behavior.
8. Collect intervention data.
9. Review intervention data.
10. Review the findings and related social-story procedures (pp. 14–15).

These steps are generally consistent with recommendations made by Gray. Gray (1994) warned that using photographs or illustrations with excessive detail may cause difficulties with some children who may try to interpret the information literally, or may be unable to generalize the situation beyond the environment represented in the picture. Because of the highly individualized characteristics of students with autism, there will likely be cases where this technique is undesirable or ineffective.

Another method of presenting information to students with autism is through music, specifically through song lyrics. Thaut (1992) identified music as a carrier of nonmusical information as one of the ways that music therapy can be used with individuals with autism. Nonmusical information may include spatial concepts, academic facts, and social skills information. The information may be incorporated into familiar, preferred musical selections, or may be set to original music in a genre favored by the student.

The earliest music therapy study specifically addressing social skills in autism comes from Stevens and Clark (1969). The subjects for this study were five boys diagnosed as having autism. Pre and posttest data came from a preexisting Autism Scale that measured functioning on three scales: nature and degree of relationship to adult; communication; and drive for mastery. Eighteen weeks of music therapy interventions occurred between the two assessment periods. The therapist incorporated various instruments and techniques including singing, improvising on the child's responses, and action songs. Analysis of group data revealed that subjects improved functioning significantly on each of the three scales. Individual data indicated that only one subject made no significant gains. Although treatment procedures of this experiment are somewhat vague, it paved the way for subsequent research with this population.

Several additional studies in this area focus on increasing social

interactions between students with a disability and their typically developing peers (Gunsberg, 1988; Humpal, 1991) or parents (Wimpory, Chadwick, & Nash, 1995). The techniques incorporated attempted to create a common ground (music) through which the two groups may socially interact. Eidson (1989) used musical interactions to directly instruct social interaction skills. Data indicated that although the contact control group made some gains, the experimental group demonstrated a greater degree of generalization stability of behavior in the general classroom environment.

From this review, it is apparent that many individuals with autism respond positively to music and music therapy interventions. While results are variable both within and between subjects, the same can be expected with nearly any form of intervention with this population. It is equally important to note that while none of the examples demonstrated high levels of efficacy for all subjects, none of the example indicated a decrease in social skill level.

Although research indicates that individuals with autism may display varying degrees of auditory defensiveness or sensitivity, these students frequently have positive responses to music (Thaut, 1987). Thaut (1992) made three conclusions regarding the musical responses of individuals with autism:

1. Many autistic children perform unusually well in musical areas in comparison with most other areas of their behavior, as well as in comparison with many normal children.
2. Many autistic children respond more frequently and appropriately to music than to other auditory stimuli.
3. Little is known about the reasons for the musical responsiveness of autistic children. However, the most promising explanation may lie in the knowledge of brain dysfunction and perceptual processes of autistic children (p. 188).

Since autism is a highly individualized disorder, there will certainly be individual cases where the degree of auditory defensiveness is sufficiently pronounced so as to contraindicate the use of musical interventions. Nonetheless, research indicates that music may be tolerable and even preferred by many individuals within this population (Blackstock, 1978; Kolko, Anderson, & Campbell, 1980).

Although it has been noted that students with autism are generally not aural learners, the music centers of the brain are separate

and distinct from the receptive language centers (Gardner, 1993). This observation may explain a person's ability to instantly recall the lyrics to a song they have not heard in 15 years, but the inability to remember the information cited in a history class 2 days prior. The ability to easily remember information presented in a musical format may be a vital tool when attempting to impart significant information to students with autism.

If dealing with a student who has an affinity for music, or who prefers musical interaction over verbal, the retention of the social information provided in social stories might be greater if presented in musical form. This type of intervention may promote repetitions of the story, increase cooperation during the intervention, and provide an avenue for recall of the information contained within the social story, resulting in increased social skills and appropriate behavior.

The purpose of the present study was to investigate the effects of a musical presentation of social story information on the behaviors of students with autism. Both empirical and anecdotal claims have been made for the efficacy of the social story technique, which provides information regarding social situations and suggests appropriate responses. The rationale for the integration of the musical component comes from research suggesting that students with autism may prefer auditory (musical) forms of stimuli to both verbal (Blackstock, 1978) and visual (Kolko et al., 1980). This preference suggests that presentation of social stories through a musical medium may enhance efficacy by increasing student involvement, attention, and repetitions. Further rationalization comes from Buday (1995) who suggested that musical presentation of information may increase skill acquisition over a spoken version. A final piece of support comes from Dr. Temple Grandin, who herself has been diagnosed with autism. In her writings about her own development, Grandin makes several references to her relationship with music. She noted that during her childhood she was engaged in physical and musical activities for 2 to 3 hours a day and that "a strong emphasis on these types of activities is an important part of a successful autism program" (Grandin, 1988a, p. 1) and that some children with autism are able to sing responses before they are able to speak them. Regarding her own musical abilities, Grandin (1988b) noted that she "can hear a song once or twice and reproduce the melody and pitch accurately" (p. 148). Clearly music has some impact on

the functioning of individuals with autism. This study seeks to explore a mechanism by which music may be used to enhance social learning and behavioral appropriateness.

Method

Participants

Participants in the study were students with a primary diagnosis of autism attending an elementary school in eastern Iowa. Selection of participants was based on teacher referral and their previous positive responses to general music and/or music therapy so as to exclude participants who might demonstrate aversive reactions to auditory musical stimuli. Additionally, participants were selected who had not previously received social story interventions to remediate the target behavior identified for the present investigation.

The four referrals used for the present research were males between the ages of 6 and 9 and attended either the first or second grade. All four were verbal and possessed at least prereading skills. The students spent some portion of their day in a self-contained classroom with other same-grade individuals with autism. Each had displayed positive reactions to previous experiences in both music education and music therapy.

Procedure

The 10-step procedure for creating and implementing a social story program designed by Swaggart et al. (1995) was used as the basis for the research procedure. Teachers in the elementary school were informed about the present study, and were asked to refer students they believed to be good candidates. After referrals were received, a letter was sent home to students' parents or guardians to obtain informed consent for research participation. Once consent was obtained, Step 1 involved the author consulting with each student's classroom teacher to identify an appropriate target behavior. Target behaviors were selected that were the most pertinent to the child's social and academic development, and behaviors that were best suited for social story intervention. For Step 2, each targeted behavior was operationally defined for the purpose of data collection. The time of day when the teacher felt the target behavior was most likely to occur was also identified; data were collected during this time.

The third step involved the collection of baseline data. These

data were collected by either the student's classroom teacher or an instructional associate assigned to the student. A data collection form was created for each student. This form included the student's name, their target behavior, and the operational definition of the target behavior. Data were collected as frequency tallies of the targeted behavior exhibited by the student, or responses to these behaviors made by teachers.

Steps four through six entailed actual composition and construction of the traditional social story. Each story was written using the prescribed social story ratio (Gray, 1997) of zero to one directive or control statements to every two to five descriptive or perspective statements. Sentences used in the story were written at or about the reading level of each student, as determined by the classroom teacher. The Flesh Reading Ease Scale was used to determine readability. A score of 85 or higher was arbitrarily chosen as criterion for reading ease by the researcher and the classroom teachers. These scores were calculated using Microsoft Word™ 98. One to two sentences were used on each page of the story. Appropriate illustrations were created for each story using the Boardmaker™ software (Version 1.2). These simple icons were used specifically for their lack of complexity so that students did not focus on unnecessary details. The printed stories with accompanying icons were placed on black construction paper, with the graphics and text printed on white paper with black ink (Gray, 1994). Each page of the story was then laminated and fastened together in a book format. The text of each social story may be found in Table 1. The author also composed original music for each story using the story sentences for lyrics, which was notated using Finale™ 98 for Windows.

After the completion of baseline data collection, the social story was either read or sung to the student (Step 7) by the author immediately prior to the data collection period. This step was carried out in seclusion to reduce distractions caused by classroom activity. Following presentation of the social story, the student was returned to class for intervention data collection (Step 8). The classroom teacher or instructional associate collected these data in the same manner as the baseline data.

Step nine was comprised of data graphing and analysis. Each student's data were graphically represented for visual analysis. Following the collection of all 20 data points, a series of dependent-samples *t*-tests were performed to answer three research questions:

TABLE 1
Social Story Texts and Reading Ease Scores

Subject	Story title	Text/Lyrics	Flesch Reading Ease Score
Peter	TV Talk	Sometimes I watch TV or movies at home. While I'm at school, I will try not to talk about the things I watched at home. If I say things that I heard on TV, my friends might not know what I'm talking about. My friends like it when I talk about other things with them. If I talk about TV, I might not hear what Mrs. W is telling me. Mrs. W. Likes it when I don't talk about TV. I'll try not to talk about TV when I'm at school.	97.8
Brian	Following Directions	Mrs. W will have work for me to do in class. Mrs. W will give me directions on what I should do. I need to listen to the directions even if I do not like the work. I can do things I like to do if I follow directions quickly. Mrs. W is happy when I follow directions and do my work. I will try to follow the directions that Mrs. W gives me.	90.2
Nathan	Using a Quiet Voice	Sometimes I need to use a quiet voice. People might talk loudly when they are outside. People talk quietly when they are inside. If I talk quietly inside, my friends and teachers can still hear me. If I yell inside, I might scare my friends and teachers. I don't like to scare anyone. I will try to talk quietly inside.	90.9
Justin	Using a Quiet Voice	People talk quietly when they are in class. My friends and teachers can hear me when I use a quiet voice inside. It hurts my friends' ears if I use a loud voice. My friends cannot hear the teacher if I make loud noises in class. We all need to hear what the teacher is saying in class. I will try to use a quiet voice while I am in class.	99.5

1. Is the use of a traditional read social story more effective in modifying the target behavior than the no-contact control condition?
2. Is the use of a musically adapted social story more effective in modifying the target behavior than the no-contact control condition?
3. Is there a significant difference between the efficacy of the two treatment types?

Levene's test for equality of variance was used for each comparison to be made. The first baseline condition was compared to the first treatment condition, and the second baseline to the second treatment. The final *t*-test compared the two treatments directly (e.g., B:C.). The statistical package SPSS Version 8.0 for Windows was used to perform all computations. Outcomes of graphing and statistical analysis can be found in the results section of each individual case study.

An ABAC/ACAB counterbalanced multiple-treatment design was used to investigate the difference in the target behavior between baseline (A) and traditional social stories (B) or their musical adaptation (C). Five days of data collection took place for each condition, which exceeds the minimum recommendation of 3 days per condition made by Tawney and Gast (1984). Subjects one and three received the conditions in the order ABAC while subjects two and fur used the order ACAB. This counterbalancing of treatment order was implemented to minimize any learning or order effects associated with receiving one condition or the other first (Tawney & Gast, 1984).

The author collected interobserver reliability data on the target behavior for 2 of 5 days for each condition for calculation of interobserver reliability. The formula agreements divided by agreements plus disagreements times 100% was used for calculating reliability. An agreement was defined as both observers scoring the same frequency of a target behavior during the observation period.

Case Study 1—Peter

Target Behavior

Peter displayed many typical characteristics of autism including aversion to touch, underdeveloped peer relationships, and difficulty coping with changes in routine or environment. Peter's echolalia was especially pronounced. Phrases and sound effects from movies or television shows were repeated most frequently. Commonly, Peter would select violent or aggressive words or phrases from this media and use them when frustrated or dissatisfied. For example, Peter would often tell his teachers or associates that he was going to "crush them like Godzilla," or "blow them up like the aliens." The clothing he wore on a given day would also encourage repetition of television or movie sounds. If wearing an ar-

ticle of clothing with a particular character from a movie or television show, Peter would often assume the role of that character for the duration of the day. This behavior not only hindered his own academic development, but tended to spawn additional echolalia from other members of his self-contained class. The behavior targeted for this study was Peter's delayed echolalia of movie and television media, which was dubbed "TV Talk" by his classroom teacher. Operationally, the behavior was defined as the production of each word, phrase, or noise that was deemed to have originated from television or movies. All successive repetitions of the same vocalization were tallied during data collection. This behavior was observed to be most prominent immediately after arriving at school each morning at 8:30 a.m.

Implementation Procedures

Following the identification of the target behavior, a social story was created that focused on minimizing "TV Talk" while at school, and the importance of doing so. The title of the story was "TV Talk." Peter was assigned to the treatment order ABAC.

As the beginning of the school day was identified as the period during which the target behavior was most prominent, the segment of time between 8:30 a.m and 9:30 a.m. was used for data collection. All data collection took place in Peter's self-contained classroom. Peter had a one-on-one associate who accompanied him throughout most of the day. This individual was responsible for data collection, as she was also the one who had the closest proximity to Peter and could therefore hear his verbalizations clearly.

During intervention periods, the author met Peter immediately after he arrived at school. Peter was taken to a secluded area of the school where interference from other staff and students would not be distracting. During Condition B, the author read the story to Peter as he followed along by either speaking simultaneously, or by following the words with his finger. During Condition C, the author would sing the story to Peter with the accompaniment of a guitar. Peter generally either mouthed the words along with the song, or pointed to the words as the author sang. After meeting with the author, he was returned to his classroom at which point data collection began. The author collected reliability data on 2 days of each condition, for a total of 8 days. Mean interobserver reliability across all four conditions was .86.

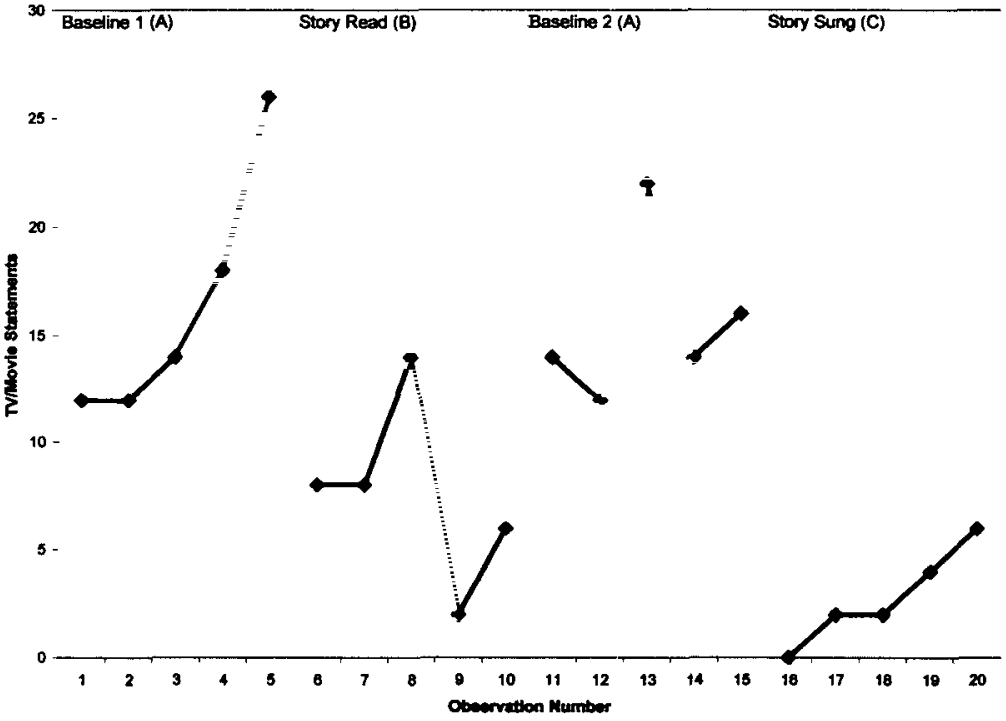

FIGURE 1.
Frequency of TV/Movie statements made by subject Peter by condition.

Results

Visual analysis of the graphed data (Figure 1) showed an upward trend during the first baseline condition. This trend dropped dramatically immediately after implementation of the reading condition. The graph indicated a reduction of the target behavior from the baseline during both treatment conditions. Furthermore, there were fewer occurrences of the target behavior during the music condition than during the reading condition. On the first day of the music condition, there were no recorded instances of the target behavior. Throughout the music condition, there was an upward trend; however, behavior levels did not approach those observed during baseline conditions.

A *t*-test comparing the first baseline condition to the reading condition (Research Question 1) showed a significant difference ($p = .03$) between the two conditions (see Table 2). When comparing the second baseline condition to the music condition (Research Question 2), a significant difference was also found ($p = .000$) (see Table 2). The final comparison between the two treatment types in-

TABLE 2

T-tests for Condition Comparisons for Subject "Peter"

Comparison	*t*	*df*	*p*
A1:B	2.69	8	.03
A2:C	6.40	8	.000
B:C	2.19	8	.06

dicated no significant difference ($p = .06$), although this value approaches significance (see Table 2). Levene's test for equality of variances indicated that equality could be assumed for each comparison being made.

Case Study II—Brian

Target Behavior

Brian displayed difficulty in following directions. After the classroom teacher gave an instruction, he would generally stare back with a flattened affect and make no response. The teacher frequently had to repeat the instruction multiple times before any response was elicited. This reaction was pervasive in all settings in which Brian was observed. It was the teacher's opinion that this delay was not a result of misunderstanding, but of opposition. The behavior targeted for this study was Brian's difficulty following directions after the first time they were stated. Operationally, the behavior was defined as each repetition of an instruction presented to Brian until an appropriate response was made. The classroom teacher did not feel that this behavior occurred more frequently at any specific time of day.

Implementation Procedures

A social story was created discussing the importance of listening to the teacher, following her directions, and the rewards that may result. After the story's composition, original music was composed using the words of the story as lyrics. Brian was assigned to the counterbalanced treatment order ACAB.

As no specific time of day was identified as being more troublesome for Brian, the time period from 10:45 a.m. to 11:45 a.m. each day was arbitrarily selected for data collection. All data collection took place in Brian's self-contained classroom. As the classroom

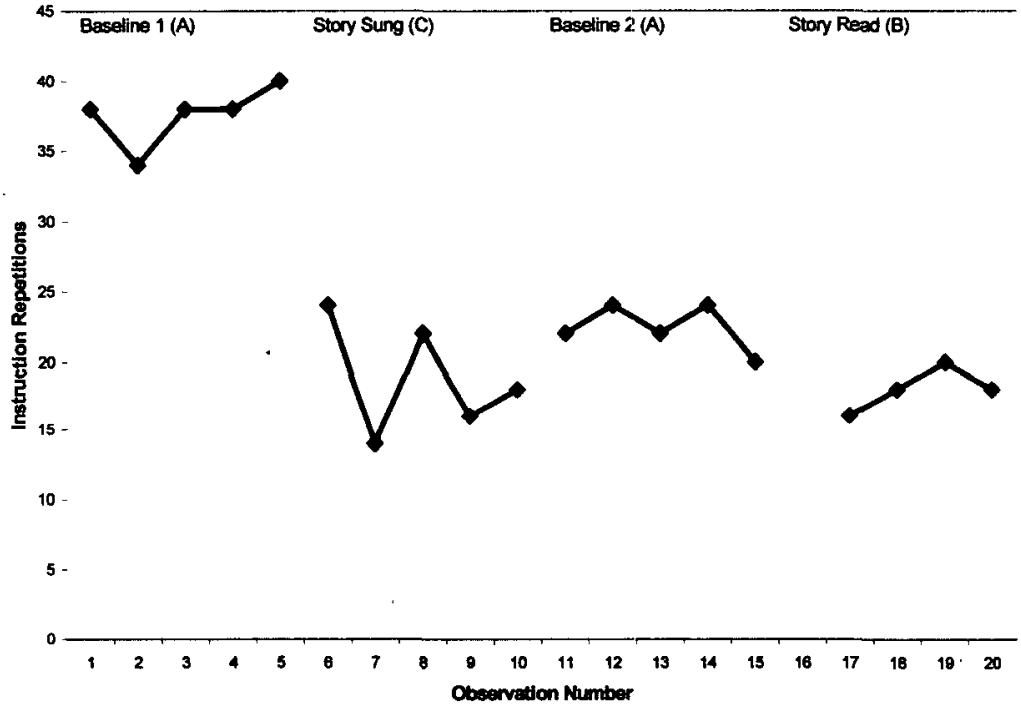

FIGURE 2.
Frequency of instructional repetitions used with subject Brian by condition.

teacher was the one giving Brian instructions, she was also the one who assumed responsibility for primary data collection.

During treatment conditions, the author removed Brian from class long enough to read or sing the story. After completing the story, Brian was returned to class and data collection began. As his reading ability was well below grade level, Brian was unable to read or sing the story along with the investigator; however, he was able to follow the words with his index finger as the author read or sang. Reliability data were collected on 2 days of each condition, for a total of 8 days. Mean interobserver reliability across all four conditions was .94.

Results

Figure 2 depicts a visual representation of the data collected. This figure shows a relatively high level of behavior occurrences during the first baseline condition, followed by a sizeable decline after the implementation of the first treatment condition. The subsequent return to baseline condition does not achieve the levels seen in the first baseline. As such, the decline seen during the sec-

TABLE 3
T-tests for Condition Comparisons for Subject "Brian"

Comparison	*t*	*df*	*p*
A1:C	8.96	8	.000
A2:B	3.96	7	.01
C:B	.36	7	.73

ond treatment condition is less pronounced. There appears to be little difference, however, between the reading condition and the singing condition.

A *t*-test comparing the first baseline condition with the singing condition (Research Question 2) showed a significant ($p = .000$) difference (see Table 3). When comparing the second baseline condition to the reading condition (Research Question 1), a significant ($p = .01$) difference was also found (see Table 3). The final comparison between the two treatment condition yielded no significant difference ($p = .73$), although this value approaches significance. Levene's test for equality of variances indicated that equality could be assumed for each comparison being made.

Case Study III—Nathan

Target Behavior

Nathan displayed many of the characteristics associated with autism including aversion to touch/proximity of others, underdeveloped peer relationships, difficulty coping with changes in routine or environment, and some distinctive motor mannerisms especially hand flapping. Nathan displayed only limited echolalia, and did not tend to mimic the motor movements of others. Nathan had difficulty modulating the volume of his voice to match the environment. Essentially, he displayed two volume levels: a comfortable indoor speaking voice and an intensely loud shouting voice. Very little of the gradient between these extremes was ever displayed. Nathan's loud voice not only scared other members of the class, but also made behavior management and classroom instruction within the self-contained classroom difficult, as the loud voice would spark inappropriate behaviors or echolalia in other children. The behavior targeted for this study was Nathan's use of his loud voice, with a goal of reducing the frequency with which he

used it. Operationally, the behavior was defined as any time a teacher or instructional associate had to tell Nathan to use a "6-inch voice," an "inside voice," a "quiet voice," or told him "shh." Repeated instructions to use an appropriate voice were all tallied, even if they were correcting the same incident. Only verbal prompts were counted during data collection. The classroom teacher did not feel that this behavior occurred more frequently at any specific time of day.

Implementation Procedures

After identifying the target behavior, a social story was created that focused on reducing the use of the loud voice in favor of the more appropriate "inside voice." The story also noted that the use of the loud voice tended to frighten classmates and teachers. The story was entitled "Using a Quiet Voice." Original music was composed to accompany the words to the social story. Nathan was assigned to the treatment order ABAC.

Since there was no identified time during which Nathan was more likely to use his loud voice, the time period from 9:30 a.m. to 10:30 a.m. was arbitrarily chosen for data collection. All data collection took place in Nathan's self-contained classroom. Nathan had a one-on-one associate who accompanied him throughout most of the day. This individual was responsible for data collection as she was also the one responsible for telling Nathan to use an appropriate speaking voice. During treatment conditions, the author removed Nathan from class long enough to read or sing the story. After completing the story, Nathan was returned to class and data collection began. As his reading ability was well below grade level, Nathan was unable to read or sing the story along with the investigator; however, he was able to follow the words with his index finger as the author read or sang. Nathan was typically able to realize the appropriate time to turn the pages of the story. Occasionally the author had to prompt Nathan to turn pages at the appropriate time. Reliability data were collected on 2 days of each condition, for a total of 8 days. Mean interobserver reliability across all four conditions was .88.

Results

Visual analysis of the graphed data (Figure 3) indicates a reduction of the target behavior from baseline during both treatment

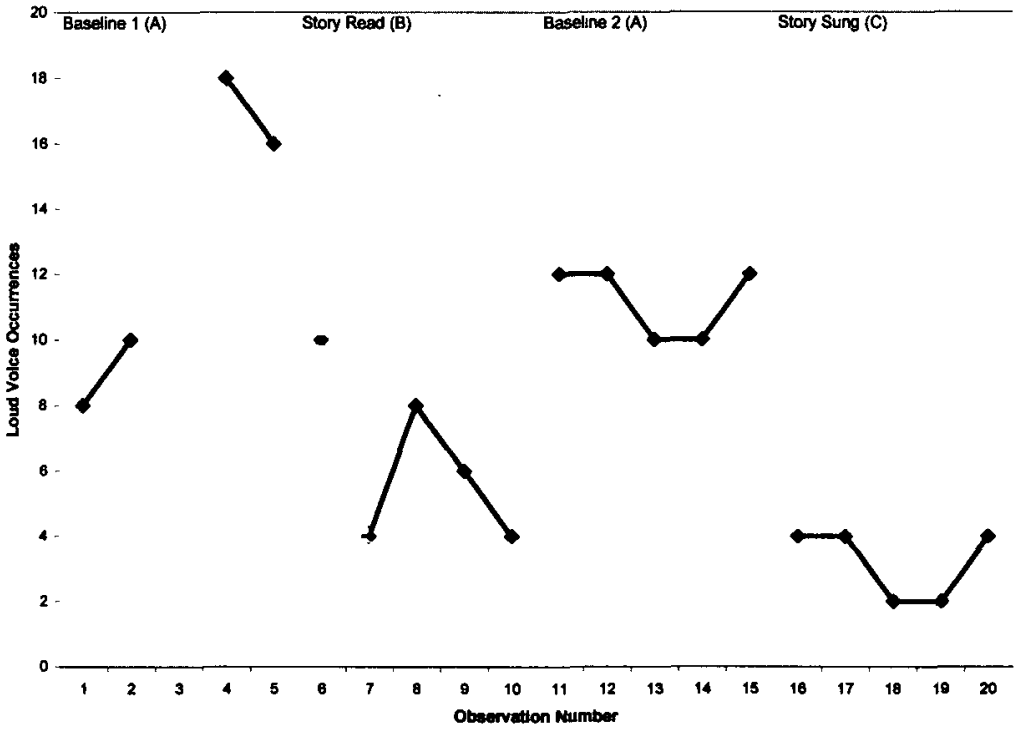

FIGURE 3.
Frequency of loud voice corrections used with subject Nathan by condition.

conditions. Over the course of the two treatment conditions, a general downward trend in the behavior frequency can be seen. The frequency of the target behavior was noticeably lower and more stable during the singing condition than during the reading condition.

A *t*-test comparing the first baseline condition to the reading condition (Research Question 1) showed a significant difference ($p = .03$) between the two conditions (see Table 4). When comparing the second baseline condition to the music condition (Research Question 2), a significant difference was also found ($p = .000$) (see Table 4). The final comparison between the two treatment conditions also yielded a significant difference ($p = .04$) (see Table 4). Levene's test for equality of variances indicated that equality could be assumed for each comparison being made.

Case Study IV—Justin

Target Behavior

Justin displayed many typical characteristics of autism including underdeveloped peer relationships, some aversion to touch, and occasional motor mannerisms. Justin had an affinity for memoriz-

TABLE 4
T-tests for Condition Comparisons for Subject "Nathan"

Comparison	*t*	*df*	*p*
A1:B	2.67	7	.03
A2:C	11.55	8	.000
B:C	2.53	8	.04

ing obscure facts, such as reciting the precise number of days until any major holiday. Prominently, Justin had difficulty dealing with change in his routine or environment. Major or unexpected changes frequently resulted in periods of sobbing and confusion bordering on panic. Justin was never observed displaying echolalia. Like Nathan from Case Study III, Justin had extreme difficulty controlling the volume of his voice. His two discreet volume levels were an intense shouting voice and a very soft speaking. The volume gradient between these two extremes was rarely observed. In addition to talking loudly, Justin would frequently make loud nonsense noises when displeased with something happening in class. This included very loud sighing and moaning. In both his regular education and self-contained classes, Justin's loud voice made behavior management and classroom instruction difficult. Justin was frequently removed from the self-contained classroom because his voice was too loud to allow other members of the class to concentrate. Two members of Justin's self-contained class had aversions to loud sounds. Justin's voice frequently initiated behavior problems in these individuals. The behavior targeted for this study was Justin's use of his loud voice at inappropriate times, with a goal of reducing the frequency with which he used it. Operationally, the behavior was defined as each time a teacher or instructional associate had to tell Justin to lower his voice or to use a "quiet voice," and "inside voice," or a "6-inch voice." Repeated instructions to use an appropriate voice were all tallied, even if they were correcting the same incident. Nonverbal prompts were not included in the data collection. Justin's classroom teacher did not feel that the target behavior occurred more frequently at any specific time of day.

Implementation Procedures

A social story was composed that addressed the need for Justin to use an appropriate vocal volume while talking inside. The story also focused on the fact that if a loud voice was used in the class-

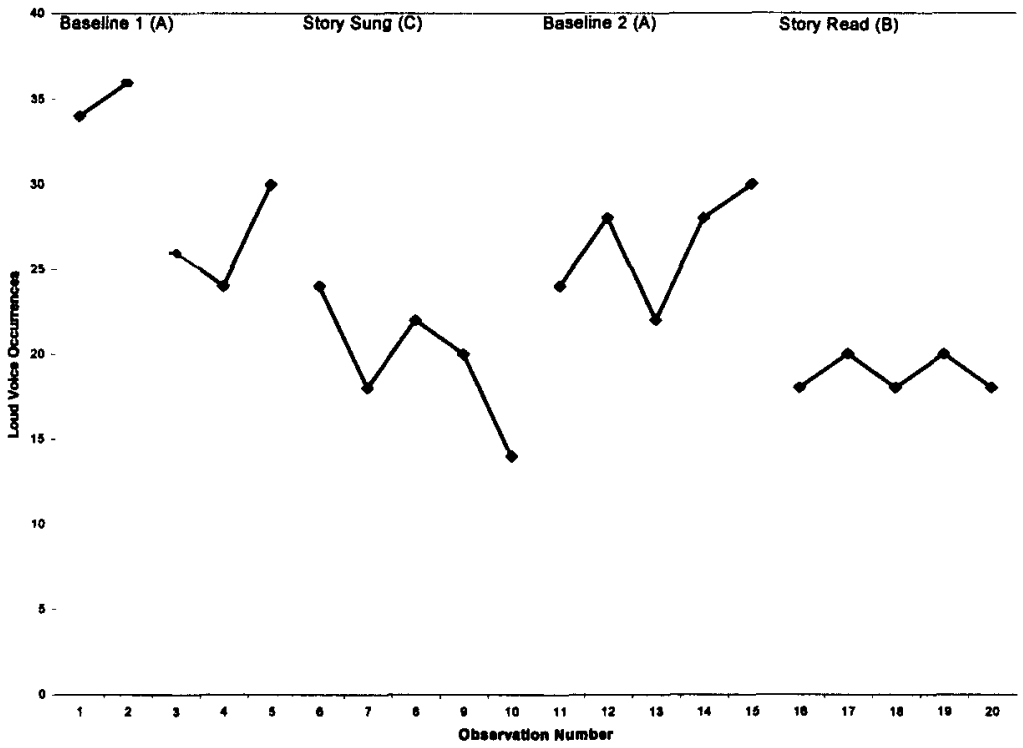

FIGURE 4.
Frequency of loud voice corrections used with subject Justin by condition.

room, other members of the class could not hear what the teacher was saying. This story, which is different from that written for Nathan, was also entitled "Using a Quiet Voice." Original music was composed to accompany the words to the social story. Justin was assigned to the counterbalanced treatment order ACAB.

The time period from 1:30 p.m. to 2:30 p.m. was arbitrarily selected for data collection. All data collection took place in Justin's self-contained classroom. Justin had a one-on-one associate who accompanied Justin throughout most of the day. This individual was responsible for data collection as she was also the one responsible for telling Justin to use an appropriate speaking voice.

During treatment conditions, the author met Justin at the door of his self-contained classroom as he was transitioning there from his regular education classroom. Justin was taken to a secluded area and the story was either read or sung. After this was completed, Justin was returned to his self-contained class and data collection began. During the reading condition (B), Justin would follow the words with his index finger as the author read. During the

TABLE 5
T-tests for Condition Comparisons for Subject "Justin"

Comparison	*t*	*df*	*p*
A1:C	3.64	8	.01
A2:B	4.91	4.88*	.01
C:B	.48	8	.67

*Adjusted by Levene's test for equality of variances.

music condition (C), Justin would attempt to sing along with the author while following the words with his finger. Reliability data were collected on 2 days of each condition, for a total of 8 days. Mean interobserver reliability across all four conditions was .93.

Results

Visual inspection of the graphed data (see Figure 4) showed that both treatment conditions were associated with fewer instances of the target behavior. However, there was no clear difference between two treatment conditions themselves. Instances of the behavior were more erratic during the music condition, and stabilized during the reading condition.

A *t*-test comparing the first baseline condition to the music condition (Research Question 2) yielded a significant difference ($p = .01$) (see Table 5). A comparison between the second baseline condition and the reading condition (Research Question 1) also yielded a significant difference ($p = .01$). However, equality of variance for this comparison could not be assumed as dictated by Levene's test. A modified degrees of freedom figure was used in computing this significance value (see Table 5). The final comparison between the two treatment conditions produced nonsignificant results ($p = .67$) (see Table 5).

Discussion

The purpose of the present study was to investigate the effect of a musical presentation of social story information on the behaviors of students with autism. Social stories are a means of incorporating an individual with autism's propensity toward visual learning with educationally necessary behavior modifications. The frequent references in the literature regarding the affinity and preference for music rationalize the musical adaptation made to the social stories

in this investigation (Applebaum, Egel, Koegel, & Imhoff, 1979; Kanner, 1943, 1951; Kolko et al., 1980; Rimland, 1964; Sherwin, 1953; Thaut, 1987, 1988).

Further evaluation of the results and a comparison of the outcomes of each case is warranted. In all instances, implementation of either form of the social story (traditional or musical) was successful in reducing the target behaviors of each subject. This claim is supported both graphically and statistically. In fact, the change between baseline and subsequent treatment condition was significant at the $\propto = .05$ level for all eight comparisons. These results were expected, as previous research regarding social stories indicated drastic change in behavior after implementation (Kuttler et al., 1998; Swaggart et al., 1995).

Data for all cases under each condition were typically erratic. This is also consistent with data collected for previous social story studies. A target behavior was only extinguished to zero during one observation period (Peter, Music Condition). Had treatment phases been longer, behavior extinguishing may have been more frequent as seen in previous social story research (Kuttler et al., 1998; Swaggart et al., 1995).

For the cases in the present investigation, volatility and unpredictability from day to day undoubtedly affected behavior rates. Events that took place at home would also have affected each student's behavior in school the next day, especially for Peter, whose echolalic material was derived from television and movies. The variability in daily performance is one of the accepted risks when conducting single-subject research, especially with this population. The nature of the present investigation precluded the collection of additional data points for each condition. The attainment of stable baselines and treatment data would have been instrumental in helping to find more apparent differences between the two treatments, both visually and statistically.

It should be noted that the frequency of the target behaviors occurred least often during the music condition. These results were consistent irrespective of the counterbalancing treatment order. In all four cases, the behavior frequency during the second baseline was consistently lower than during the initial baseline. This demonstrates some learning effects taking place after the implementation of a treatment phase, but not a treatment order effect. The difference between the reading and music conditions was sometimes

minute and difficult to detect (Brian and Justin), and only achieved significance in one case (Nathan). Despite a lack of clear evidence indicating greater treatment efficacy, it can at least be stated that the musical adaptation was consistently at least as effective as the traditional model. The difference between the conditions was significant in Nathan's case, although Peter's data approached significance.

Of particular note is Peter's response to the music condition. Although generally amenable to music interventions, Peter would usually whine and whimper when asked to do the musical version of the social story. Despite this negative reaction, Peter would comply with the instructions. During several music therapy sessions outside of the present research, Peter would reproduce the information contained in the social story. For instance, while playing an instrument in an individual music therapy session, Peter would spontaneously sing portions of the information contained within the social story. It is this spontaneous recall of musical information that the author deems most important about the musical adaptation. The ability for musical recall may provide another avenue by which these students may remember and incorporate vital information.

Each of the songs composed to accompany the social story was original and therefore previously unknown to the students. In purely clinical settings, it may be more practical to incorporate a technique known as "Piggybacking" rather than composing original music. Piggybacking is a process whereby the lyrics to a well-known song are altered to contain the desired information. For the purposes of this adaptation, a clinician or teacher could use a melody that is already familiar to the student to convey social story information. Because the student already knows the melody, recall and practice such as that observed with Peter may be more frequent and spontaneous. This recall may be advantageous when trying to modify behaviors.

There are clearly limitations imposed by the experimental design used. As mentioned earlier, the duration of each intervention was chosen for the convenience of completing this project. The absence of stability within conditions detracts from the usability of the present data. Generalization of these findings to other situations is difficult, if not impossible. When the vast difference between individuals with autism is taken into account, it cannot be assumed that

these results would be replicable with other individuals. Indeed, traditional social stories may be ineffective with some individuals, and the incorporation of music may be wholly undesirable for some clients.

Another limitation concerns the use of this technique by individuals who lack musical training. Even if educators wished to incorporate a musical version of a social story, their lack of musicianship may preclude it. Here again, the technique of piggybacking may be of assistance, as it requires less musical training than composing original music. If an original accompaniment is desired, the educators must take it upon themselves to seek out someone with musical training to compose it.

Further research is clearly warranted to provide further validity to the practice of traditional social stories and the present musical adaptation. Most importantly, research is needed that can provide more generalizeable results using larger groups and more rigorous experimental and statistical models; however, the nature of autism poses some limitations on doing so. Most notably, the extreme idiosyncratic differences between all individuals with autism would make creating large groups with homogeneity of variance virtually impossible. The very individualized nature of social stories also makes work with groups difficult. Since social stories are written specifically for individual cases, finding a meaningful number of individuals who could benefit from the specific information in any one social story would be difficult. The author can also foresee an extension of the present research involving piggybacking the social story to a tune familiar to the subject to aid in information recall.

The present research clearly provides no answers or definitive claims. Rather, it attempts to add one more piece to the difficult puzzle of remediating social skills with this population. Incorporation of this adaptation is not expected to be successful with all individuals. Instead, it provides an alternative resource for use in attempting to provide a multi-modal learning environment for students with autism.

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