Chapter 6
Investigating the Effectiveness of Paper-Based and Computer-Presented Social Stories for Children with Autism Spectrum Conditions in an Autism-Specific Special School

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Introduction

Autism spectrum conditions (ASCs) are pervasive and enduring conditions, characterised by a qualitative impairment in social functioning and communication and restricted or stereotyped behaviours (Frith, 2003). It has been reported that the number of children in the Irish education system diagnosed with ASCs has increased from 1868 in the academic year 2006/2007 to 2741 in the academic year 2008/2009 (Parsons et al., 2009). This increase reflects the findings of prevalence-rate projects in the USA and UK (Centre for Disease Control and Prevention, 2009; Baron-Cohen et al., 2009). There is no equivalent study in Ireland. In light of the growing numbers of this community of children in schools, it is important that educational psychologists provide increased support in the form of effective interventions to alleviate difficulties and increase access to education. There has been a growing movement towards the concept of accountability in practice, resulting in an emphasis on evidence-based practice (EBP) and the evaluation of interventions (Dunsmuir et al., 2009; Frederickson, 2002).

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Social Stories

One intervention that is widely used and popular for the ASC community, but yet to be validated as an EBP, is that of Social Stories, short narratives that provide information about social situations in a clear, easily understandable way. Social Stories help to alleviate confusion, leading to improvements in social understanding and social functioning (Gray & Garand, 1993). In a 2009 survey, Reynhout and Carter (2007) found that, of teachers who worked with children with ASC, 100% had used Social Stories and 97% thought they were effective. In an American study, Day (2012) found that the majority of school psychologists surveyed recommended the use of Social Stories for children with ASC.

The use of Social Stories was developed by Carol Gray through direct work with children with ASC (Attwood, 2000), resulting in several published articles and books containing recommendations on their construction and implementation (e.g. Gray & Garand, 1993; Gray, 2004). Since the first description of Social Stories by Gray and Garand (1993), the concept has evolved, with updated instructions and criteria on how to construct and implement the stories. At their inception, the first set of criteria recommended the use of four different sentence types in story construction, namely, descriptive, perspective, directive and affirmative sentences (*see* Table 6.1). Two additional sentence types, control and cooperative sentences, were introduced in 2000 (Gray, 2000). The Social Story ratio – the ratio of the various categories of sentences that should be included – was established and included in publications following the initial introductory article (e.g. Gray, 2004). It is recommended that at least twice as many descriptive sentences as any other sentence type be included, to ensure the narrative focuses on describing events and explaining other people's behaviours (Gray, 2004).

Table 6.1 Social Story sentence types and their descriptions

Descriptive sentences	These are statements of fact, with no assumptions or opinions.
Perspective sentences	These describe, or refer to, the inner states of other people, including thoughts, beliefs, feelings, etc.
Cooperative sentences	These identify what other people will do to assist the child/young person.
Directive sentences	These identify responses, or a range of optional responses, to guide the child's/young person's behaviour.
Affirmative sentences	These enhance the meaning of surrounding statements, often expressing a widely held view or opinion in a given culture.
Control sentences	These are statements written by the child/young person themselves, identifying strategies that they will use to implement the Social Story.

Adapted from Gray (2004)

Evidence Base for Social Stories

In addition to their popularity, Social Stories have also been described as 'simple, acceptable, classroom friendly' (Chan et al., 2011). Despite the popularity and practical indications for the utility of Social Stories, along with their widespread use (Reynhout and Carter, 2006), their use has not yet been established as an evidence-based practice. Research into this form of intervention has produced variable results. The National Autism Centre (2009) lists story-based interventions amongst established practices in terms of interventions for people with ASCs. Other conclusions are more tentative, describing evidence as 'promising' while not yet established (Simpson, 2005). Early studies provided some positive results for the efficacy of Social Stories, both in reducing inappropriate behaviours and in increasing adaptive behaviours (Ali & Frederickson, 2006; Reynhout & Carter, 2006). On the other hand, the research base has been described as 'at best incomplete' (Sansosti et al., 2004).

A number of published reviews have highlighted methodological weaknesses inherent in much of the early research in the topic, which limits the extent to which results can support the efficacy of the intervention (Kuoch & Mirenda, 2003; Sansosti et al., 2004; Reynhout & Carter, 2006; Ali & Frederickson, 2006). Many studies have failed to isolate Social Stories as the sole variable, as they have included various other elements such as visual schedules, token economies and prompting and comic-strip conversations, making it difficult to ascertain which of the intervention agents were responsible for change. The use of experimental designs that can be described as pre-experimental, such as AB designs and case-study formats, was identified as a weakness in many cases. Failure to comply with the criteria and sentence ratios set out in the Social Story publications has also been highlighted as a weakness.

Some of the reviews identified a lack of data on a number of important aspects, including generalisation, maintenance, social validity, treatment integrity and lack of clear participant description (Ali & Frederickson, 2006; Reynhout & Carter, 2006). Reynhout and Carter provided the first review that examined outcome strength, reporting variable to weak effects for interventions. The variability in effect size across reviewed studies led the authors to suggest that there was particular intervention or participant characteristics that may have moderated the effects of the intervention.

More recently published studies in the area have demonstrated increased methodological rigour. This is evidenced in the increased use of study designs with greater internal validity, such as ABAB and multiple-baseline designs (Styles, 2011). However, reviews including more recently published and higher-quality research indicate that the results of studies remain highly variable, with some interventions assessed as highly effective and others as ineffective (Kokina & Kern, 2010; Test et al., 2011). In both meta-analyses and individually published studies, researchers have begun to investigate the causes of such variability, examining specific intervention and participant characteristics in relation to outcomes. In their

meta-analysis, Kokina and Kern (2010) grouped studies according to various criteria and compared effect sizes between groups. Some interesting preliminary data is outlined, which suggests, for example, that brief interventions had higher effect sizes than longer ones; that interventions that targeted simple behaviours were more effective than those that targeted complex ones and that interventions with comprehension checks were more effective than those without.

Richmond Mancil et al. (2009) assessed the differential effects of paper- and computer-assisted Social Stories on inappropriate behaviour in children with autism. They found that the computer-based presentation was slightly more effective and was preferred by the children. In a study with three participants, Cummins (2010) found that the Social Story intervention was less effective for one child, who had lower IQ scores than the other participants. In a randomised control-group study, Quirmbach et al. (2009) found that the success of the Social Story for participants was predicted by their score on the Verbal Comprehension Index of the Wechsler Intelligence Scale for Children, Fourth Edition (WISC IV) (Wechsler, 2003). Specifically, children with scores within the borderline range or above made significant improvements, while those with lower scores did not make significant improvements.

There is a general trend for more recently published studies involving Social Stories to be of increasing quality. However, even the most recently published articles still fail to include important aspects of intervention analysis, such as data on generalisation, maintenance and peer comparison. Studies also include varying degrees of detail in participant description (Richmond Mancil et al., 2009; Schneider & Goldstein, 2010; Cummins, 2010; Chan et al., 2011). It has also been suggested that ecological validity has decreased with increased levels of methodological rigour (Styles, 2011). Two studies specifically discuss the possible confounding effects of researcher presence during data collection (Schneider & Goldstein, 2010; Cummins, 2010). Many studies also fail to conduct or report comprehension checks (Styles, 2011), despite evidence that increased comprehension can lead to increased effectiveness of the intervention (Reynhout & Carter, 2007) and of the study (Kokina & Kern, 2010).

There is a substantial body of research that points to the possible utility and effectiveness of computer-based interventions for individuals with ASC. Technology is desirable as an instructional tool, as it can replace costly personnel. Particular forms of technology, such as touchscreen tablet devices, can be used for multiple purposes. Reviews of studies utilising various types of computer technology indicate promising results for their use in improving social skills (DiGennaro Reed et al., 2011), communication skills (Ramdoss et al., 2011) and academic literacy (Pennington, 2010). It is suggested that computer-aided instruction may be particularly suited to individuals with ASCs and their unique pattern of difficulties – for example, for the teaching of social skills in rule-based format (Moore et al., 2000) and in compensating for difficulties in understanding naturally spoken language (Janzen et al., 2006). A review of studies into computer-aided social-skills interventions reveals that the majority of studies in the area used video/DVD technology (58.6%), followed by audio script (17.2%) and computer programmes (13.8%).

None of the studies utilised the relatively new smart technology available in handheld devices or tablet computers.

One early study (Hagiwara & Smith-Myles, 1999) and some recent studies (Richmond Mancil et al., 2009; Chan et al., 2011) have begun to inform us about the impact of different modes of presentation on outcome data, employing the use of technology to present stories. Howley and Arnold (2005) highlight the importance of the mode of presentation. They suggest that technology may be used to enhance stories, as it allows for a visual mode of presentation, a mode of learning often preferred by individuals with ASC. The use of technology represents an efficient, cost-effective and flexible method for creating Social Stories. Richmond Mancil et al. (2009) also provide data to suggest that children may have a preference for this type of story. However, none of the studies that presented Social Stories using technology employed the use of the increasingly popular range of devices with touch technology, such as the Apple iPad. Children with ASC, their parents and even therapists are beginning to use iPads and apps as tools for education and augmentative communication, as well as for leisure (Davis, 2011). The current study will investigate the use of this technology in creating and presenting Social Stories.

Echoing calls from numerous researchers and reviewers, it is suggested that more methodologically sound research, with clear participant description and addressing the effects of moderator variables, should be conducted. The current study will attempt to extend the literature further by addressing some of these flaws and by investigating particular intervention characteristics. The particular research questions addressed in the current study were:

- Can Social Stories presented in paper-based and computer-based formats increase adaptive social behaviours in children with ASC in an autism-specific school setting?
- Are there characteristics of the participants, the intervention or the social and environmental context that can be used to predict the effectiveness of the intervention?

Methodology

Participants

An autism-specific special school in the Dublin area of Ireland was selected to take part in this research. For inclusion in the study, children had to have (a) a current diagnosis of ASC, (b) at least some basic skills in oral communication and reading, and (c) a skill area, not currently targeted by another intervention, that was identified by teachers and parents as an area in need of improvement. Teachers in the school were first consulted to identify whether there were children who matched these criteria, and two children were identified. Information letters and consent forms were then sent to the parents of these children, both of which were returned

with consent given. Prior to the intervention, the participants were assessed using the Social Responsiveness Scale (SRS) (Constantino & Gruber, 2005) and the Diagnostic Reading Analysis (DRA) (Crumpler & McCarthy, 2008).

Names of participants have been changed to protect anonymity.

Christopher

Christopher was aged 15 years and 3 months at the time of the current study. Christopher received a diagnosis of autistic disorder and general developmental delay in 2002 (CA: 5:8). The diagnostic instrument used in the assessment was not specified in the report. In a psychological report dated 4 February 2010 (CA: 13:4), Christopher obtained a score that was reported to be within the range of 42–50, consistent with a profile of Moderate Intellectual Disability. His performance on the DRA reading test indicated a reading age of 8 years and 3 months, with a comprehension standard score of <69 – in the 'very weak' category. The teacher report questionnaire of the SRS resulted in a 't' score of 62 – in the 'mild to moderate' range. Christopher had been exposed to Social Stories, both in school and at home, prior to the current study.

David

David was aged 9 years and 3 months at the time of the current study. David received a diagnosis of Pervasive Developmental Disorder Not Otherwise Specified (PDDNOS) in 2007 (CA: 4:6). The instruments used to make this diagnosis were the Childhood Autism Rating Scales and the Autism Diagnostic Observational Schedule. In a psychological assessment dated 18 January 2008, David obtained a score on the Wechsler Preschool and Primary Scale of Intelligence Third Edition (WPPSI III) in the range of 56–66, consistent with a profile of Mild Intellectual Disability. His performance on the DRA reading test indicated a reading age of 7 years and 0 months, with a comprehension standard score of <69 – in the 'very weak' category. The teacher report questionnaire of the SRS resulted in a 't' score of 65 – in the 'mild to moderate' range. David had been exposed to Social Stories at home to alleviate anxiety about novel events, but not in school, prior to the current study.

Target Behaviours

Behaviours were selected in consultation with parents and teachers using interview and observation data. For both children, the target behaviour was to begin a conversation by getting a person's attention. The behaviour was specifically defined as gaining a person's attention before initiating a conversation, either (a) physically, e.g. by tapping the person on the shoulder, or (b) verbally, e.g. by saying 'excuse me' or the person's name at a volume level audible over the typical classroom noise level.

Social Stories

Through random assignment, Christopher was assigned to the computer-based Social Story, while David was assigned to the paper-based version. A story was written for each child according to Gray's (2004) criteria, including descriptive, perspective and directive sentences and adhering to the Social Story ratio. The stories contained information on when the behaviour might occur and described some options for obtaining attention and what the result might be.

The computer-based story was created and presented on an Apple iPad using the *Stories2Learn* application. Photographs of Christopher himself in the school setting were used to illustrate the story (see Fig. 6.1). The story was presented in the default font and settings of the application. The paper-based story was printed on white paper in 16-point comic sans font, laminated and spiral bound and included colour photographs of David to illustrate the story (see Fig. 6.2).

Design

A single-subject AB multiple-baseline-across-participants design was employed, whereby there was an initial baseline phase, followed by the intervention phase. The multiple-baseline design is a widely used experimental design that allows researchers to evaluate the effects of an independent variable across different behaviours,

Fig. 6.1 Sample page layout for computer-based Social Story

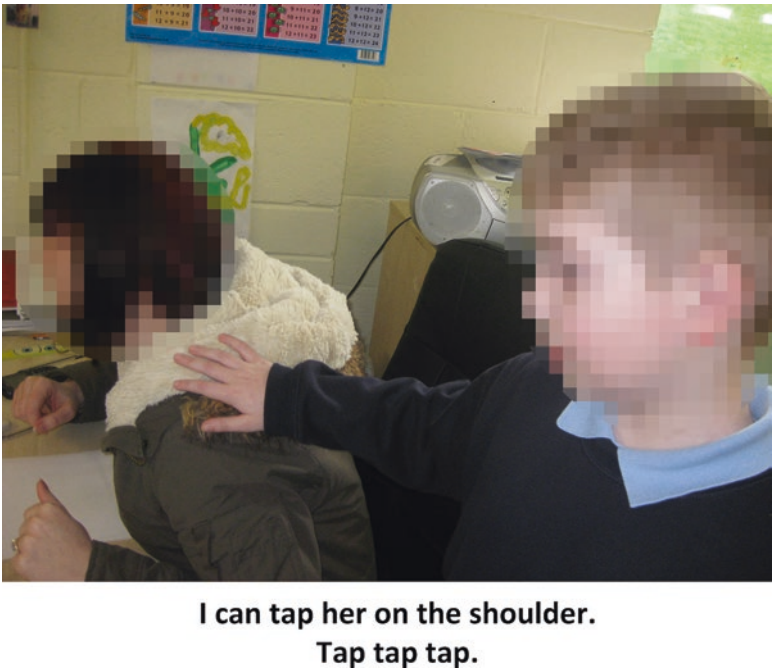

Fig. 6.2 Sample page layout for paper-based Social Story

settings or participants (Cooper et al., 2007). Using this design, baseline measures were initiated for both participants, but intervention was initiated with the first participant, while the second remained under the baseline conditions. When the first participant demonstrated maximal response, intervention began with the second participant.

Procedure

Data collection took place in the participants' respective classrooms in the morning, between the beginning of the school day and the first break at eleven o'clock. Two special needs assistants (SNAs), who were typically involved in the children's school day, were trained by the researcher to record the behaviours. Participants were currently receiving individual instruction in communication tasks as part of their Individual Education Plans. This was part of their normal school day and involved tasks requiring them to speak with other members of the school staff, e.g. to make requests and ask questions. The SNAs recorded whether or not the target behaviour occurred during these interactions. If it did occur, a '+' was recorded on a pre-designed recording sheet; if it did not occur, a '−' was recorded.

The baseline phase lasted for five sessions for Christopher, and nine sessions for David, after which the intervention phase began. The Social Story was read to the children once by the SNA on the first day it was introduced, following which the children read the story themselves, both in the initial session and on subsequent days in the intervention phase. Comprehension was checked following story reading by asking three questions from a selection of five comprehension questions that were predetermined and written on a separate sheet.

As the intervention did not produce the same gains for David as it did for Christopher, a third phase was introduced. This involved adding role play, a model prompt and verbal praise as reinforcement in order to ascertain whether the skill could be learned by augmenting the Social Story with additional strategies.

Inter-observer Agreement (IOA)

The current study utilised trial-by-trial IOA, involving dividing the total number of trials by the number of trials for which the observers agreed and multiplying this figure by 100. The minimum number of recommended trials for which IOA should be calculated is 20%, with preferable levels of 25–33% (Cooper et al., 2007). The current study calculated IOA for 33% of trials for Christopher and 30% of trials for David, by comparing the observations of trained staff and the researcher. Inter-observer agreement was 100% for Christopher and 96% for David.

Treatment Integrity

The terms ‘treatment integrity’ and ‘procedural fidelity’ refer to the extent to which the independent variable is applied consistently (Cooper et al., 2007). In order to assess treatment integrity in the current study, a checklist was provided to teachers on which to record the completion of the different steps of the procedure during the intervention phase. Treatment integrity for each step (story reading and asking of comprehension questions) was calculated by dividing the number of times the step was completed by the number of days of the intervention and multiplying by 100. Treatment integrity was 100% for both participants.

Treatment Acceptability

The Intervention Rating Profile (IRP-15) is a measure of treatment acceptability (Martens et al., 1985). Items are rated on a six-point Likert scale, ranging from ‘strongly disagree’ to ‘strongly agree’, with higher scores indicating greater acceptability. The IRP-15 has high internal consistency (Cronbach’s a = 0.98) and high

validity coefficients with related measures ($r = 0.86$). The participants' two class teachers completed the questionnaires and both returned a score of 85 out a maximum of 90, indicating high treatment acceptability. They also reported in interviews that they would use the intervention again. They thought that it was easy to implement and that it fitted in well with the daily running of the classroom.

Data Analysis

Each participant's behaviour was graphed on a line graph, as a percentage of expressions of the target behaviour per opportunity during their communication tasks. Data points in the baseline and intervention conditions were analysed visually for variability of performance, level of performance, direction and degree of trends in the data.

Maintenance and Generalisation

Maintenance was assessed for Christopher at 1 week and 2 weeks after finishing the Social Story intervention phase, after which the Social Story was no longer available. The communication task was repeated without the reading of the Social Story, as it had been in the baseline phase. Generalisation was assessed for Christopher by prompting him to speak with another person outside of the context in which the skill was taught, e.g. in another classroom while he was on a break. It was also assessed qualitatively through teacher observations, which were relayed through interview to the researcher. For Christopher, the effects of the Social Story maintained within the communication task that it was taught in at the 1- and 2-week follow-up stages. In terms of generalisation, Christopher demonstrated the target skill in areas of the school other than the classroom he learned it in. Qualitative reports suggest that he initiated conversations appropriately in different contexts only some of the time and not often at home. Some generalisation was seen for David, as he was observed by the researcher to initiate conversations appropriately. David was reported by the teachers to do this some of the time, but not all of the time, in school.

Results

Data Analysis

The children's performance in the baseline and intervention phases were recorded daily, and results were plotted on a line graph (Fig. 6.3). Christopher demonstrated a significant increase in the target behaviour during the initial intervention phase, while David did not.

Christopher
During the baseline phase, Christopher's target behaviour was completely absent. On the sixth day, when the Social Story was introduced, an immediate increase in the target behaviour was observed. The target behaviour increased throughout sessions, reaching the maximum level of 100% by day 8. It dropped back to 80% on day 9, before becoming stable at 100% on day 10 and remaining at this level until the end of the intervention phase. During the intervention phase, the percentage of interactions with the target behaviour ranged from 40% to 100% (M = 87%). During his communication tasks in the baseline phase, Christopher approached people who were speaking to other people and interrupted without any initiation or spoke to people who were not listening as he had not gained their attention. During the

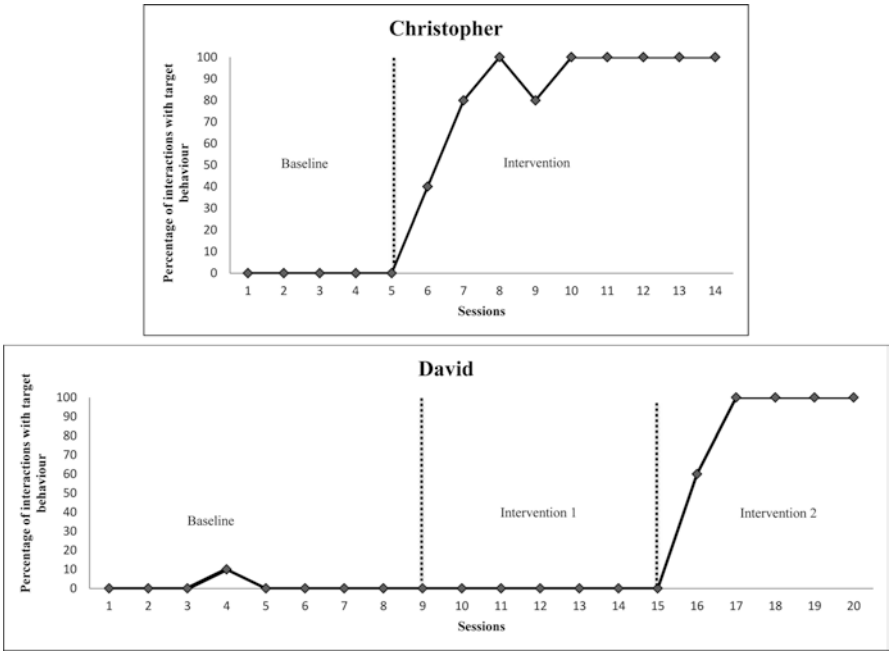

Fig. 6.3 Percentage of interactions within communication task in which target behaviour was observed

intervention phase, Christopher was observed to say 'Excuse me', followed by the person's name, in order to gain someone's attention. Christopher's number of correct responses to the comprehension questions correlated positively with the level of the target behaviour. On the first 2 days of the intervention phase, he got a number of the comprehension questions incorrect, but by the third day, he was responding correctly to all of the questions.

David

During the baseline phase, the target behaviour was completely absent for David, except for one occurrence on day 4 in which he gained the attention of a listener by saying 'Excuse me'. Teacher reports suggested that this anomaly was due to inadvertent verbal prompting by a staff member. During baseline, David approached people during his communication tasks but spoke in a quiet voice, standing far away from the listener and without any formal initiation to the conversation. The Social Story was introduced on day 10, as Christopher's level of response was reaching its maximum level. The target behaviour remained absent during this phase, and similar behaviours were observed during the communication tasks as in the baseline phase. After 2 days David was responding correctly to all comprehension questions. A second intervention phase was introduced on day 16, involving significant amounts of additional teaching including role play, model prompting and verbal praise as reinforcement. The level of interactions with the target behaviour increased with this level of additional support and reached the maximum of 100%. Maintenance was not assessed for David, due to time restrictions.

Discussion

This study evaluated the effects of two Social Story formats on the level of socially appropriate behaviour of two children in an autism-specific school setting. The frequency of the target behaviour – appropriate conversation initiations – increased for the first child, using the computer-based format, but not for the second child, using the paper-based story. The introduction of role play, model prompting and verbal praise led to an increase in the target behaviour for the second child. Such variable results for different participants within studies have been demonstrated previously in the research (Sansosti & Powell-Smith, 2006; Cummins, 2010; Schneider & Goldstein, 2010). Evidence of short-term maintenance for one participant and some generalisation of skills for both participants were found. Treatment acceptability was found to be high for both participants.

For Christopher, the level of the target behaviour increased from 0% in the baseline condition to 87% in the intervention phase. These results are consistent with recently published, methodologically rigorous studies investigating the effects of Social Stories as the sole intervention variable and demonstrating increases in socially appropriate behaviour in participants (Schneider & Goldstein, 2010; Chan et al., 2011). This is despite some indications that Social Stories may be more

effective in decreasing inappropriate behaviours than increasing appropriate behaviours in research that predates these publications (Kokina & Kern, 2010). Young people of Christopher's age group have been relatively neglected in Social Story research. Kokina and Kern (2010), in their review of single-case research in the area, report that only 19% of studies included participants of age 12 or above. This study suggests that children of secondary school age may benefit from the intervention.

The results for the second participant, David, were quite different, reflecting the variation in the success of Social Stories, both within studies (Sansosti & Powell-Smith, 2006; Cummins, 2010; Schneider & Goldstein, 2010) and between studies, as highlighted in reviews (Reynhout & Carter, 2006; Kokina & Kern, 2010). A variety of participant and intervention characteristics have been proposed as differently moderating the effects of Social Stories by the authors of previous studies and reviews, including the type of behaviour targeted (Schneider & Goldstein, 2010), the IQ level of the participants (Cummins, 2010; Kokina and Kern, 2010), the level of communication deficits (Cummins, 2010; Kokina & Kern, 2010) and the level of treatment integrity and quality of the Social Story (Sansosti & Powell-Smith, 2006). In the current study, the Social Story was successful with the child within the Moderate Intellectual Disability range of intelligence, but not for the child within the Mild Intellectual Disability range. This is the converse to previous research, in which children with higher IQ levels demonstrated greater gains (Cummins, 2010; Kokina & Kern, 2010). IQ level is unlikely therefore to be a moderating variable in this study.

There may be aspects of the social and environmental context that contributed to the lack of success of the intervention for David. Reports from teachers and parents indicated that Christopher was more likely to readily approach people than David. The results of the SRS also indicated that Christopher's score on the Social Motivation scale (58) was lower than David's (76), indicating that David had greater difficulties in this area. As it appeared that David understood the story, evidenced through his correct responses to the comprehension questions, it is possible that a lack of motivation prevented him from initiating conversations successfully as outlined in the story. Crozier and Tincani (2007) discuss the possibility that a participant in their study may not have demonstrated gains after a Social Story intervention due to a similar lack of motivation. The participants' Social Communication score on the SRS differed to a smaller degree. Christopher's score was seven points lower than David's, indicating fewer difficulties. Differences in communication may also therefore have moderated the intervention effects.

Prior exposure to Social Stories for skills learning may have influenced the outcome of the intervention – Christopher had been exposed to Social Stories in school, but David had not. David's educational history involved the use of the Applied Behaviour Analysis model for teaching. This involves prompting, modelling and reinforcement, amongst other things, but not teaching through narratives. In the second intervention phase, familiar teaching strategies were added to the Social Story, and these resulted in success. The teaching methods added in this phase with David are similar to those used in a Social Stories intervention package reported by

Chan and O'Reilly (2008), in which Social Stories combined with role play and verbal prompts were successful in increasing appropriate social behaviour and decreasing inappropriate behaviour. This also suggests that for some children, Social Stories alone may not be enough to acquire skills.

The results of the maintenance probes for Christopher indicated that, at 1-week and 2-week follow-up stages, the treatment gains were maintained. It is noted in several reviews that early studies in the Social Story literature often neglect to report maintenance effects (Sansosti et al., 2004; Reynhout & Carter, 2006; Ali & Frederickson, 2006). More recently, maintenance effects have been more routinely reported by researchers but with variable results (e.g. Sansosti & Powell-Smith, 2006; Richmond Mancil et al., 2009). Some generalisation of skills was seen for both participants in the current study. This is similar to the results of a study by Delano and Snell (2006), which noted generalisation from a play area setting to a classroom setting for two out of three of the participants.

Measures of treatment acceptability – quantitative data (IRP-15) and qualitative data in the form of teacher and parent interviews – indicate that the intervention was highly acceptable to both teachers and parents, who rated it as effective. It should be noted that the addition of other teaching strategies in the second intervention phase for David meant that his teacher's ratings probably did not reflect her opinion of the Social-Story-alone phase. Teachers and parents stated that they would use the intervention in the future, reporting that they found it easy to use and a good fit for the environment they were working in. This adds to the findings of previous studies, which suggest that this intervention is very acceptable and classroom-friendly (Chan et al., 2011; Cummins, 2010; Reynhout & Carter, 2009).

This study indicates that the *Stories2Learn* app on an iPad is an effective mode of presentation of Social Stories, which also has high social validity in terms of acceptability as well as practicality. The use of such technology is flexible and cost-effective. Machines such as iPads can be used for several different purposes, such as augmentative and alternative communication, as well as for generating and presenting Social Stories. The Social Story presented on an iPad was seen as easier to construct, better presented and possibly more attractive to children. Richmond Mancil et al. (2009) also found that computer-based stories were preferred by children in their study. In a book endorsed by Carol Gray, Howley and Arnold (2005) highlight the importance of the mode of presentation used for Social Stories. They suggest that technology may be used to enhance stories, as it allows for a visual mode of presentation, a mode of learning often preferred by individuals with ASC.

This study adds to the literature in a number of ways. Firstly, the study demonstrates increased methodological rigour over much of the previously published research, by including a number of indicators of quality research. Secondly, ecological validity was maintained: using school staff to implement the Social Stories and collect data provides ecological validity and reduces the confounding effect of researcher presence discussed in previous studies (Schneider & Goldstein, 2010; Cummins, 2010). Finally, the study also extends the literature by investigating a previously unexamined mode of presentation, in the form of iPad technology. This, along with clear participant descriptions, allowed for the consideration of the results

in the light of potential participant and intervention moderating variables. Moreover, the study triangulated results by adding qualitative data from interviews and observations to the quantitative data gathered. Purely positivist paradigms are predominantly employed in many Social Story studies. Such studies could be enhanced with more interpretivist approaches, which would allow for an analysis of additional within-subject factors as well as social and environmental variables that may moderate intervention effects (Styles, 2011).

Limitations

Although the study addresses some of the flaws inherent in previous research, a number of limitations remain. Peer comparison data was not collected, as there were no typical peers available in the autism-specific setting. This type of data is gathered in order to ensure that skills being taught and acquired are valid in terms of what would be expected for a typical peer (Cooper et al., 2007). Using the design in the current study, it was not possible to experimentally compare the effects of using the two different formats of the Social Story, the computer-based and paper-based formats. Previous studies have used designs that would allow for such a comparison, such as the ABABABCBC multicomponent reversal design used by Richmond Mancil et al. (2009). This study includes data on the children's preference for computer- or paper-based stories. This was not possible in the current study – the participants used only one format each, so they could not choose a preference.

Conclusions and Future Directions

The current study confirms previous findings that Social Stories as a sole intervention variable presented in computer format can be effective for increasing socially appropriate behaviour in some children with ASC within particular settings. It also demonstrates that the intervention has variable effects and may not be effective as a sole intervention variable for all children with ASC. The study provides preliminary evidence for the efficacy of presentation of Social Stories via tablet computer and smart technology, as well as the acceptability and practicality of this mode of presentation. Some of the possible participant, intervention and environmental characteristics that may moderate the effects were discussed, such as the moderating effect of social motivation, the level of communication deficits and prior exposure to Social Stories. Despite a plethora of individual studies, as well as reviews into Social Stories, there are few that use Social Stories as the sole intervention agent and are experimentally rigorous, with even the most recent studies neglecting to report important information such as generalisation and maintenance data. Future research should continue to isolate Social Stories as the sole intervention agent and employ rigorous experimental designs incorporating quality research practices.

Moreover, consideration should be given to ensuring that qualitative data is included and used to provide a reliable and valid context in which the quantitative data can sit. Further work might also consider larger sample sizes across a variety of settings and compare the use of Social Stories on touchscreen devices to paper-based stories. Future studies should provide clear and detailed participant information and attempt to experimentally manipulate moderator variables, in order to generate profiles of responders and non-responders to the intervention.

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