



Citation for published version:

Camilleri, L, Maras, K & Brosnan, M 2021, 'Mothers' and practitioners' insights on the use of digitally-mediated social stories with children on the autism spectrum: a convergent mixed-methods study', *Research in Developmental Disabilities*, vol. 119, 104104. <https://doi.org/10.1016/j.ridd.2021.104104>

DOI:

[10.1016/j.ridd.2021.104104](https://doi.org/10.1016/j.ridd.2021.104104)

Publication date:

2021

Document Version

Peer reviewed version

[Link to publication](#)

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Mothers' and practitioners' insights on the use of digitally-mediated social stories with children on the autism spectrum: a convergent mixed-methods study

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To appear in: *Research in Developmental Disabilities*

Abstract

Background: While end-user interest in digitally-mediated Social Story (SS) intervention for children on the autism spectrum is growing, research on the use of SSs in digital form is lacking.

Aims: This study aimed to investigate how digital-mediation can influence parents' and practitioners' attitudes towards the SS intervention as well as impact their perceived competence in their ability to administer the intervention.

Methods and Procedures: This study used a convergent mixed-method design. Nineteen participants (ten practitioners and nine mothers) participated in two focus group sessions. Participants then engaged with a digitally-mediated SS and completed a pre- and post-engagement survey measuring attitude, competence and user experience with the intervention.

Outcomes and Results: The mothers' perceived competence ratings improved after engaging with digitally-mediated SSs. Mothers and practitioners also indicated that digitally-mediated SSs increased their perceived efficiency, while mothers felt it improved their autonomy and further empowered them as end-users.

Conclusion and Implications: Digitally-mediated SS has the potential to effectively address challenges related to intervention implementation whilst also empowering further the end-user.

Keywords: Social Story; Digitally-mediated; Autism Spectrum Disorder; Mothers, Practitioners; Mixed-methods.

Highlights?

- Mothers of children with ASD and practitioners reported a positive attitude towards digitally-mediated SS intervention.

- Digital mediation significantly improves mothers' perceived competence with the SS intervention.
- The use of digitally-mediated SSSs is perceived as empowering, especially for mothers.
- Digitally-mediated SSSs could offer opportunities for self-determination for children on the autism spectrum.
- Digitally-mediated SSSs can potentially improve procedural integrity and augment a mother's ability to develop and deliver SSSs.

1. Introduction

Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental disorder characterized by difficulties in social communication, social behaviours and restrictive and repetitive behaviours, activities or interests (American Psychiatric Association, 2013). Recent studies indicate that around 1 in 54 children in the USA is on the autism spectrum (Maenner, Shaw, Baio et al., 2020). A wide range of interventions have been developed to support the needs of children on the autism spectrum (Odom et al., 2010), one of which is the Social Story (SS) intervention (Gray & Garand, 1993). SSs are personalised narratives consisting of bespoke text and illustrations, developed to provide children on the autism spectrum with accurate information which they can then use to learn a new skill and to understand and function appropriately in different social situations (Bucholz, 2012; Ozdemir, 2010).

SSs are regarded as an acceptable and effective intervention by teachers (Hess et al., 2008; Moore et al., 2014) as well as parents (Green et al., 2006), and are one of the most frequently used interventions by practitioners that support children with ASD (Smith & Gillon, 2004; Hsieh, 2018). A number of studies (e.g., O'Connor, 2009; Crozier & Tincani, 2005; Golzari et al., 2015) also report on positive outcomes resulting from using SSs with children on the autism spectrum. Notwithstanding such claims, and despite their popularity, the evidence relating to the effectiveness of SSs highlight is varied in terms of effectiveness and outcomes of the intervention (e.g., Kokina & Kern, 2010; Mayton et al., 2013; McGill et al., 2015; Camilleri et al., 2021). One of the factors contributing to this variability is poor procedural integrity (Constantin et al., 2019). Procedural integrity (also known as procedural fidelity) describes the degree to which treatments are delivered competently and as intended (Reed & Coddington, 2011). Livanis et al. (2013) argue that procedural integrity is of critical importance to interventions designed for children with ASD, especially when one considers the course and symptomology of the disorder. Thus, they maintain that “there needs to be considerable work to ensure treatment adherence, improve competence and establish differentiation” (Livanis et al., 2013. p.33).

One way to reduce variability in the development and delivery of SSs (and thereby also enhancing procedural integrity), is through the use of digital technology. With this in mind, Smith et al. (2020) introduced digitally-mediated SSs to teachers, who in turn used this intervention with children on the autism spectrum. They reported that support through the use of digital-mediation (where SSs were developed using an online application and delivered

through a smart-phone or tablet) resulted in greater fidelity and subsequent positive outcomes in terms of “closeness to a goal” of the SS. Similar studies by Smith et al. (2020b) and Hanrahan et al. (2020) also produced similar conclusions: that digitally-mediated social stories were effective in producing beneficial changes in behaviour outcomes whilst also improving procedural integrity. For example, Hanrahan et al. (2020) reported an increase in the intensity of a child’s interaction with the content of the story as a result of using technology, which in turn led to better engagement and increased comprehension. Another study by Vandermeer et al. (2013) utilised iPad-presented SSs to increase the “on-task” behaviour of young children with autism during table-top activities. Outcomes of this study were mixed, although the digital mediation of SSs through iPad technology was an effective intervention for one of the three child participants who participated in the study.

SSs traditionally consist of stories which are “delivered” in print format, although various modalities have been used to deliver the intervention; from using music as a medium (Brownell, 2002; Schwartzberg, 2013), to utilising virtual reality tools (Ghanouni, 2019). The use of digital technology as an “intermediary” for both the development and delivery of interventions is appealing for autistic children and those who support them (e.g., Goldsmith & LeBlanc, 2004), and has garnered increased interest from practitioners, parents, and service users. A survey by Schueller et al. (2016) indicates that web-based tools are being recommended more than mobile-based tools by mental health providers. However, the authors suggest a strong interest in digital supports, such as mobile-based tools, by mental health providers for use in clinical settings. Another survey reported that autistic adolescents used technology in both school and home settings in a supportive manner with the aim of increasing their independence whilst reducing anxiety (Hedges et al., 2018). A similar study by Laurie et al. (2019) with parents from the UK, Spain, and Belgium sought to investigate the use of digital technology with the autistic population and address the “gaps in our knowledge about autism and technology” (Laurie et al., 2019. p. 1518). Laurie et al. reported that the patterns of technology use reported by parents of autistic children were not radically different from what would be expected of a group of children without autism. However, parents reported that technology was most commonly used to play games and watch videos, with relatively low use of autism-specific digital applications reported for educational purposes.

In sum, whilst portable technological devices such as smart-phones and tablets have gained popularity among the autism community (Yee, 2012), the empirical research on

digitally-mediated interventions is scarce (Kim et al., 2018; Chen; 2012). However, the evidence from the few studies that have explored empirically the use of digitally mediated SSs with children on the autism spectrum is promising, with benefits that go beyond improving procedural integrity (e.g., Hanrahan et al. 2020). Other digitally-mediated interventions have also been reported to be effective on a range of outcomes, including social problem solving and even emotional processing skills for individuals with autism spectrum disorders (Wilkes-Gillan & Joosten, 2016). To continue bridging the gap in knowledge about how digital technology can support individuals with ASD, the present study used a convergent mixed-method design to investigate how digital-mediation can influence parents' and practitioners' attitudes towards the SS intervention as well as impact their perceived competence in their ability to administer the intervention.

2. Methods

2.1. Research design

Parents and practitioners from the autism community, who had various degrees of experience with the traditional SS, but no experience whatsoever with digitally-mediate SSs, were first invited to rate their attitude towards SSs as well as their perceived competence in using a SS intervention (pre-engagement survey). They were then introduced to a digital application that could digitally-mediate the development and delivery of the SS intervention. After using the application to develop SSs with a particular child in mind, their initial reactions and perceptions were elicited by means of focus-group interviews. After continuing to utilise the application to digitally-mediate the SS intervention for a further two weeks, they again rated their attitude towards the SS intervention and their perceived competence, using the same set of questions used for the pre-engagement survey, were again gathered (post-engagement survey).

The rationale for the utilisation of this mixed-method approach stems from the nature of the question that this study aimed to answer: i.e., how does using digital-mediation impact attitudes towards SSs and the participants' perceived competence in their ability to administer the SS intervention. This question required insight on the impact of digital-mediation on the participant's attitude and perceived competence (quantitative data), as well as insight on the mechanisms (i.e., the process – qualitative data) that influenced that impact.

To adequately answer this question, a mixed-methods methodology that entailed opening up the research to hear a wide range of perspectives (Zachariadis et al., 2013), whilst also deepening the explanation of a phenomenon (Danermark et al., 2019), was used. A critical realist research paradigm (Bhaskar, 1978; Sayer, 2002) informed the study's philosophical assumptions. The "retroductive" logic that underpins critical realism (McEvoy & Richards, 2006) required posing the question of why events or experiences happen the way they do (Olsen and Morgan, 2005).

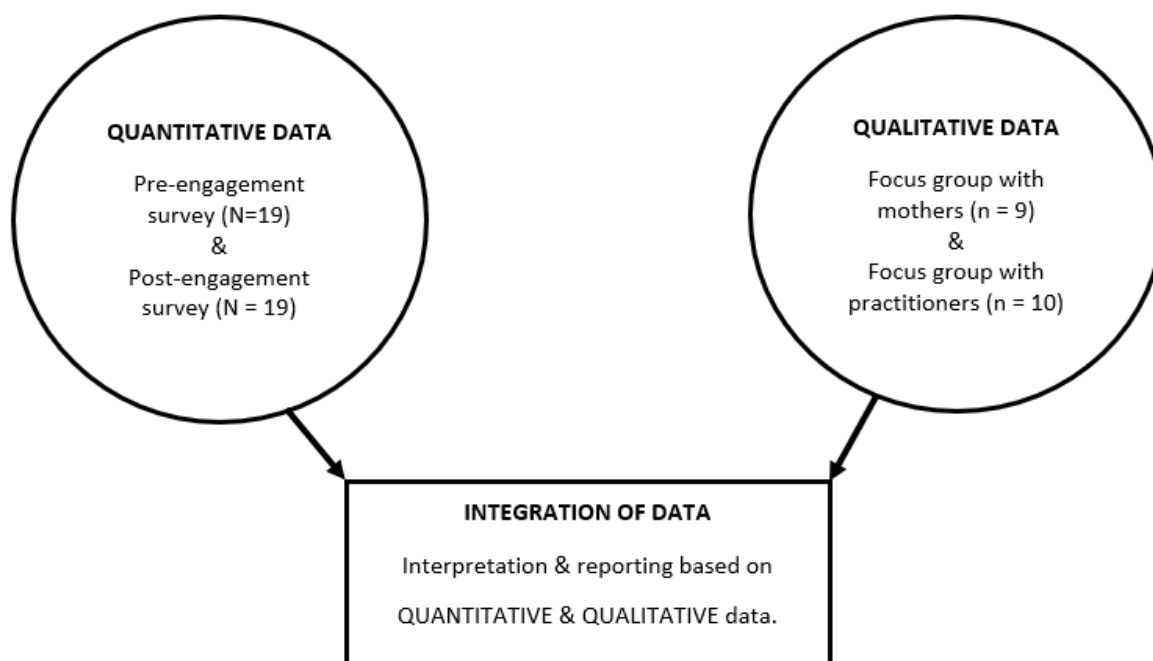
Thus, a convergent mixed-method design was used, to combine strengths of both quantitative and qualitative data types (Creswell & Plano Clark, 2018), to investigate if and how digital mediation impacts user's attitudes and competence in relation to the SS intervention. The quantitative and qualitative data were collected during a similar timeframe (Fetters et al., 2013). I.e., within a 2-week period. The objective of such a design was to "converge" different types of data to best understand the research problem (Patton, 2015) whilst giving equal weight to each type of data (as described in Johnson et al., 2007).

The qualitative data was collected through two focus groups: one with parents of children on the autism spectrum, and another with practitioners who support autistic children. Qualitative methods were used to gather rich subjective experiences (Marshall & Rossman 2006). This method also aimed to capture the potential diversity of parents' and practitioners' perceptions of their experiences with the digitally-mediated SSs.

Quantitative data was collected through two surveys: pre- and post-engagement survey with digitally-mediated SS intervention. This type of data was used to measure parents' and practitioners' attitudes as well as their perceived competence ratings at two points in time: before and after the use of the digitally-mediated SSs experience. Competence here is defined as the required knowledge and skill necessary to deliver an intervention to the standard needed for it to achieve its expected effects (Fairburn & Cooper, 2011). The visual description of this convergent design can be found in Figure 1.

Figure 1.

Convergent research design used in the present study.



2.2. Participants

Nineteen participants participated in all phases of this study. I.e., the 19 participants who completed the pre- and post-engagement surveys also participated in the focus groups. Ten participants were practitioners who support children on the autism spectrum, whilst nine were parents of children on the autism spectrum. All of the nine parents were mothers whose children's ages ranged from 5 to 12 years. The parents reported that their children all had a diagnosis of autism (as defined by ICD-10 criteria; World Health Organization, 1992) or ASD (as defined by DSM-V criteria; American Psychiatric Association, 2013), which was made by a Paediatrician, a Psychiatrist, a Clinical or Educational Psychologist, or a team of experts composed of the previously mentioned professionals.

The practitioners were all recruited by emailing an invitation to an administrative contact at a programme in Malta that provides services for autistic children and their parents. All ten practitioners specialised in autism intervention and held a Bachelor Degree in

Psychology. They were from the same organisation and had a minimum of two years of experience working with autistic children. The organisation they came from primarily focused on utilising a TEACCH approach whilst providing specialised group and individual interventions for children with autism. Initially a purposeful sampling strategy was utilised to recruit parents of children on the autism spectrum. This was carried out through an advert using social media, where participants with an interest in social stories were invited to participate. The response to this advert was low. Thus, a convenient and snowball sampling process was subsequently employed to identify participants from the autism community, who had some degree of experience with developing and/or delivering SSs, and/or who would have benefited from learning about the digital-mediation of the SS intervention. The participants confirmed that they did not have any experience with digital-mediation of SS interventions. Participant characteristics, their experience with SSs, as well as their proficiency with digital mobile technology are presented in Table 1.

Table 1

Participant demographics

	Frequency	Percentage
Role		
Parents (all mothers)	9	47.4
Practitioners	10	52.6
Total	19	100
Experience with SS ¹		
Extensive experience	16	84.2
Little/no experience	3	15.8
Age range		
18 to 25	4	21.1
26 to 35	8	42.1
35 to 45	5	26.3
46 to 55	2	10.5
Perception of proficiency at using an electronic device (smartphone/digital tablet) ²		
Proficient	18	94.7
Not proficient	1	5.3

¹ Participants who had experience with developing and delivering SSs were grouped in the “Extensive experience” category. Participants who had experience only with delivering or only with developing a SS were grouped in the “Little/No experience” category. Participants with no experience with developing or delivering a SS were also grouped in the “Little/No experience” category.

² Participants were invited to rate their perceived ability to use their digital device on a 5-point Likert scale. Participants who rated themselves from 3 to 5 were placed in the “Proficient” category. Participants who rated themselves from 1 to 2 were placed in the “Not proficient” category.

2.3. Procedure

Participants were invited by email to complete an online pre-engagement survey which was administered through Qualtrics software. Participants who completed this survey were invited to label their questionnaire using a unique self-generated code to serve as a means to match the pre- and post-engagement surveys. The self-generated code successfully enabled the researchers to pair the pre- and post-engagement survey data.

Subsequently, two focus groups, one with parents and one with practitioners, were carried out using the Zoom online platform. Prior to the focus groups, the participants were invited to download a digital SSs application (SOFA: Stories Online For Autism) on their smartphone or tablet. During the focus group they were asked to use SOFA to develop a SS. The SOFA application was co-developed together with the autism community (Constantin et al., 2017), and can be downloaded free-of-charge (SOFA-app.org) on Google-play and Apple store. Participants were then invited to answer questions and engage in a discussion that aimed to elicit their perceptions of the benefits and drawbacks of using digitally-mediated SSs.

Following the focus groups, participants were invited to keep using the SOFA application to develop SSs, with the aim of addressing specific target behaviours for a child with autism that they were familiar with. I.e., parents were invited to develop stories with their child in mind, whilst practitioners to develop stories with a child they had worked with in mind. The SOFA application asks for information about the child's age range, gender and level of understanding. Data from the SOFA application indicates that the autistic children, for who the stories were written, were within the 5 to 10 years age range. 75% were males whilst 26% were females. 53% were reported to understand single words, 42% simple sentences, whilst 5% were reported to understand full sentences.

After developing the SS, participants (i.e., mothers and practitioners) were invited to complete a post-engagement survey which sought to understand the impact that using digitally-mediated SSs had on their attitudes and competence self-ratings for developing SSs.

2.4. Ethical considerations

All recruitment and research procedures performed in this study were in accordance with the ethical standards of the University of Bath's Psychology Research Ethics Committee (PREC). Informed consent was obtained from all participants. Names were not used in the

reporting of the qualitative data and some details related to participants' characteristics have been omitted from this manuscript to further protect the participants' identities.

2.5. Measures

2.5.1. Quantitative measures

The pre-engagement survey consisted of questions aimed towards gaining a better understanding of the level of experience participants had with developing and delivering SSs. Furthermore, participants were asked to indicate their level of agreement, on a 5-point Likert scale ranging from strongly agree/very confident (5) to strongly disagree/very "unconfident" (1) on a number of statements. The statements aimed to explore their attitude towards the SS intervention (Attitude Scale; e.g., I believe that a social story is an effective intervention for individuals on the autism spectrum.), and their perceived level of competence in their ability to develop and deliver a SS (Competence Scale; e.g., I am aware that there are specific instructions/directions on how to create a social story.).

The items used to measure "attitude" were adapted from the Intervention Rating Profile – 15 (Martens et al., 1985) and the Abbreviated Acceptability Rating Profile (Tarnowski & Simonian, 1992). These measures were developed to explore the acceptability of the intervention. The items used to measure "competence" were adapted from Smith et al.'s (2020) framework for the evaluation of procedural integrity.

The post- engagement survey (refer to Appendix A) consisted of the same "attitude" and "competence" items that were administered during the pre-engagement survey. However, this survey also sought to gather information on the participants' perception of their proficiency (proficient or not proficient) of using their particular electronic device (smartphone/tablet) and gather information describing their experience of using the digitally-mediated intervention (User Experience; e.g., using the application to digitally-mediate the intervention was easy).

2.5.2. Qualitative measures

Data for the qualitative stage was gathered during focus groups with parents and practitioners. The focus groups aimed to be an empowering experience for participants by collaboratively and actively eliciting their voices and experiences as primary users of a digitally-mediated intervention, placing them at the centre of the research process, rather than merely on the fringes (Goss and Leinbach, 1996).

The focus groups were guided by a semi-structured interview schedule. The interview schedule was composed of five main questions: (1) What did you like about digitally-mediated SSs? (2) How can digitally-mediated SSs be useful for the autism community? (3) In what situation can digitally-mediated SSs be useful? (4) Are there any “downsides” to using digitally-mediated SSs? (5) What could be the limitations of digitally-mediated SSs? The questions were open-ended and were asked to gain a deeper understanding of participants’ views of utilising a digital application to mediate the SS intervention.

The two focus groups were carried out online through the use of the Zoom platform. This modality allowed us to overcome temporal and spatial barriers (see Moore, McKee & McLoughlin, 2015) whilst also providing adequate data-management and security options (see Archibald et al., 2019).

2.6. Data analysis

2.6.1. Quantitative data analysis

Data were analysed using SPSS (version 26) software. Summary scores for “attitude” and “competence” for both pre- and post-engagement surveys were computed by averaging ratings across the six “attitude” items, and six “competence” items respectively. The mean of the four “user experience” items, which formed part of the post-engagement survey, were averaged and computed into one “User Experience” variable. The scales had an internal consistency, i.e., Cronbach Alpha coefficient, of 0.83 (Attitude), 0.74 (Competence) and 0.62 (User Experience). The degree of change registered on competence and attitude scales after engaging with digitally-mediated SSs was also computed.

A paired-samples *t*-test was used to determine if participants' attitude and competence scores significantly differed between pre- and post-engagement surveys. An independent-samples *t*-test was used to determine if parents’ and practitioners’ user-experiences significantly differed. Measures of effect size, using Cohen’s *d* (1988), was calculated for each *t*-test comparison. Pearson’s product-moment correlation was used to investigate possible linear correlations between user-experience ratings and change in competence and attitude ratings.

2.6.2. *Qualitative data analysis*

Data were transcribed and analysed in terms of Braun and Clarke's (2006) process of thematic analysis. As suggested by Braun and Clarke (2006), the analysis consisted of six stages: familiarisation with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report. This process was not linear but consisted of going back and forth from one stage to another in a recurring and cyclical manner. This cyclical process also utilised tape-based analysis (Onwuegbuzie, Dickinson, Leech, & Zoran, 2009). This process placed a great deal of emphasis on familiarisation with the data in order to transcribe, and subsequently analyse, the key phenomenon of interest. Thus, after the initial reviewing and familiarisation stage, an abridged transcript, consisting of the key aspects of the focus group data, was created. The themes were identified inductively, where data itself was used to structure the analysis. NVIVO-12 software (QRS International, 1999) was employed for this stage of the analysis.

2.6.3 **Integration of quantitative and qualitative data**

Integration of qualitative and quantitative data was carried out narratively at the interpretation and reporting phase of the study as described by Fetter et al., (2013). Thus, the qualitative and quantitative data were reported and analysed separately but integrated at the reporting stage of the study (Moseholm & Fetters, 2017).

3. Results

3.1. *Quantitative results*

3.1.1. *Attitude*

There was a change between pre and post attitude ratings across all participant (N = 19) overall. However, this change was not statistically significant, $t(18) = 1.19$, $p = .251$, $d = 0.27$ (M change = 0.18, 95% CI [-0.14, 0.49]). There also was change, albeit not a statistically significant one, when looking specifically at mothers' (n = 9), $t(8) = 0.670$, $p = .522$, $d = 0.22$ (M change = 0.15, 95% CI [-0.36, 0.66]) or practitioners' (n = 10) attitudes towards SSs, $t(9) = 0.96$, $p = .364$, $d = 0.33$ (M change = 0.20, 95% CI [-0.27, 0.67]).

3.1.2. Competence

Overall ($N = 19$), there was a significant improvement in competence ratings after using digitally-mediated SSs, $t(18) = 3.34$, $p = .004$, $d = 0.91$ (M change = 0.44, 95% CI [0.16, 0.72]). The mothers reported competence significantly increased after engaging with the digitally-mediated intervention, $t(8) = 2.78$, $p = .024$, $d = 0.93$ (M change = 0.57, 95% CI, 0.10, 1.05). Although practitioners' reported competence also increased (M change = 0.32, 95% CI, -0.06, 0.70), this failed to reach statistical significance, $t(9) = 1.90$, $p = .091$, $d = 0.60$ (see Table 2).

3.1.3. User-experience

User-experience ratings did not significantly differ between practitioners ($M = 3.90$, $SD = 0.42$) and parents ($M = 3.74$, $SD = 0.60$), $t(17) = 0.68$, $p = .505$, $d = 0.31$.

A Pearson's product-moment correlation was run to assess the relationship between user-experience ratings and (1) change in attitude and (2) change in competence ratings, in the whole group of participants ($N=19$), in the parents' group ($n=9$) and the practitioners' group ($n=10$). There were no significant correlations between user-experience and competence and attitude change ratings in any of the groups; all $ps > .05$ (see Table 3).

Table 2

Descriptive statistics of attitude, competence and user experience measures.

		All participants		Parents		Practitioners	
		Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Attitude	Pre	4.38 (0.61)	3.00- 5.00	4.24 (0.71)	3.00- 5.00	4.50 (0.51)	3.33- 5.00
	Post	4.55 (0.46)	3.33- 5.00	4.39 (0.56)	3.33- 5.00	4.70 (0.31)	4.00- 5.00
	Change	0.18 (0.64)	-1.17- 1.67	0.15 (0.66)	-1.17- 0.83	0.20 (0.66)	-0.67- 1.67
Competence	Pre	3.98 (0.59)	2.33- 4.83	3.78 (0.73)	2.33- 4.67	4.17 (0.37)	3.83- 4.83
	Post	4.42 (0.34)	3.67- 4.83	4.35 (0.41)	3.67- 4.83	4.48 (0.28)	4.17- 4.83
	Change	0.44 (0.34)	-0.50- 1.50	0.57 (0.62)	-0.17- 1.50	0.32 (0.53)	-0.50- 1.00
User experience		3.82 (0.50)	3.00- 5.00	3.74 (0.59)	3.00- 5.00	3.90 (0.42)	3.33- 4.67

Table 3

Pearson correlations between user experience and change in attitude and competence ratings.

	Change in attitude ratings <i>r</i>	Change in competence ratings <i>r</i>
User experience ratings		
Parents	.58 ($p = .099$)	.62 ($p = .073$)
Practitioners	.28 ($p = .430$)	.22 ($p = .551$)
All participants	.44 ($p = .057$)	.40 ($p = .089$)

3.2. Qualitative results

Analysis of the focus groups data identified factors that influenced aspects of participants' experience of the digitally-mediated intervention. Two central themes emerged from the data: assets of digitally-mediated SSs, which had three subthemes (empowering, tech-appeal, and increases efficiency), and drawbacks of digitally-mediated SSs, which had two subthemes (highlights differences and tech-limitations). Each subtheme consisted of related codes which were grouped together. The three authors independently categorised the transcribed qualitative data and obtained 71% interrater agreement and a Fleiss' kappa of .738, 95% CI [.734, .740], $p < .001$. Discrepancies in ratings were resolved via discussion resulting in 100% agreement.

The following section provides details about the subthemes that were identified from the focus group data, as well as their constituting codes. Descriptive information, including representative quotations, are presented to highlight how the codes and subthemes elucidate the central themes of the data.

Table 4

Overview of emergent themes

Central Themes	Assets of digitally-mediated SSs			Drawbacks of digitally-mediated SSs	
Subthemes	Empowering	Tech-appeal	Increases efficiency	Highlights differences	Tech-limitations
<i>Codes</i>	<i>Parental autonomy</i>	<i>User-friendly interface</i>	<i>Practical Timesaving</i>	<i>Appear different</i>	<i>User's poor affinity with technology</i>
	<i>Enables child independence</i>	<i>Appeal of gadgets</i>	<i>Easy access to SSs</i>	<i>Feel childish</i>	<i>Hardware limitations</i>
					<i>Software limitations</i>

3.2.1. Assets of digitally-mediated SSs

Mothers and practitioners agreed on the potential for digitally-mediated SSs to serve as assets for them, their children, and their clients. Parents' focus was mainly about how the

intervention could impact their children's independence, whilst practitioners focused mainly on how the intervention could further empower parents.

Empowering. Here the term “empowering” refers to improving user confidence in developing and delivering the SS intervention. Whilst both parents and practitioners used the term when describing the process of developing and delivering digitally mediated SSs, their comments had a different focus. Practitioners specifically referred to the empowerment of parents of children with autism in terms of increased autonomy and confidence in developing and delivering the intervention: *“Parents require a great deal of support for them to create and use stories. They are unaware of the manner in which they should be creating, and also using social stories. This digital aspect could help and serve as a guide”* [practitioner].

In contrast, parents described the digitally-mediated SS intervention as a potential asset for their children: *“The child can go through it independently”* [parent]. They describe the intervention as empowering as it provides the possibility for their children to be able to carry out the intervention without the help of an adult, and as a result making them more independent. Mothers reported that *“[my child] will have another thing that he can achieve independently”*; *“This would make them feel like they have a say in their education”* [mother].

Increases efficiency. Mothers and practitioners both reported on the improved efficiency (i.e., the potential to save on wasting materials, energy, efforts and time) which digitally-mediated SSs can provide them with: *“Providing quick access to social stories which are generally time consuming to put together”* [practitioner]. The practicality, as well as potential for saving on time, were aspects which mothers found to be very appealing; *“...I can do so [write stories] within minutes and use it there and then as the need arises”* [mother]. As a result of an increase in efficiency, some mothers reported on a potential increase in use of the intervention: *“... [digitally-mediated SSs] will make the stories much less time consuming [to create] and I will use them more often”* [mother].

Both groups also reported on practical and timesaving attributes of digitally-mediated SSs: *“It saves time to create the story, it is time-consuming to create it on Word”* [practitioner], *“so we could technically write a quick one on the go, while we are out and about”* [mother]. Many participants also reported on the potential for digitally-mediated SSs to increase the accessibility of the intervention: *“The digital aspect makes SSs more accessible in general”* [practitioner].

Tech appeal. The digital/technological modality of the SS intervention was reported by mothers to be particularly appealing for their children: *“Kids with ASD love gadgets so having a story on phone/tablet would be more enticing for them and probably heed the message more”* [mother]. Mothers of adolescents were very keen about the digitalisation of the intervention, saying, *“the fact that it is an app makes it more appealing to my son [13 years old] so he would be more willing to use it. Paper is usually a reminder of 'school' work for him, so he would refuse to read it on paper”* [mother]. Some of the mothers also mentioned how having a SS on a smartphone could potentially increase her child’s cooperation: *“my son loves my phone and cooperates just to be allowed to use it”* [mother]. Practitioners did not report on such aspects of digitally-mediated SSs.

3.2.2. Drawbacks of digitally-mediated SSs

Besides the supportive aspect of the digitally-mediated intervention, focus group participants also identified a number of potential drawbacks. The user’s poor affinity with technology, as well as hardware and software limitations, seem to be areas of concern for both mothers and practitioners. Furthermore, mothers in particular reported concerns about the potential of such an intervention to further highlight children’s needs and potentially impact their children negatively.

Highlights differences. Some of the mothers commented on the risk of having children “stand-out” more when they are required to utilise digital equipment which their peers are not required to use: *“It could make some children feel different. Especially in mainstream situations”* [mother]. Furthermore, mothers also reported that some of the older children could perceive the intervention as belittling: *“Some children could feel that social stories are babyish”* [mother]. Practitioners did not report on this particular theme/issue.

Tech-limitations: Mothers and practitioners also highlighted the potential downsides of digitally-mediated SSs. Practitioners were concerned about an intervention which could be dependent on the user’s ability to understand and use technological devices such as smartphones and tablets: *“The technology part could be daunting at times for parents”* [practitioner]. Mothers also commented on the likelihood that their success or failure, in terms of developing and delivering the intervention, could be dependent on the quality and capacity of their digital devices, both in terms of hardware as well as software: *“Certain functions could be slowed because of the operating system you use to deliver the stories.*

When certain functions “freeze” or are delayed, this could lead the child to have a tantrum”
[mother].

4. Discussion

Variability in implementing the SS intervention in a naturalistic setting has raised questions regarding the intervention’s effectiveness (Mayton et al., 2013; McGill, 2015; Olçay-Gül & Tekin-Iftar, 2016). The current study used a convergent mixed-methods approach to examine how digital-mediation of a SS intervention could potentially impact parents’ and practitioners’ perceived competence and attitudes, and consequently also enhance the implementation process. Mothers’ and practitioners’ perceptions of a digitally-mediated SS intervention were also examined.

Findings indicated that using a digitally-mediated SS intervention did improve the attitude ratings towards the SS intervention (change in attitude for all participants $M=0.18$, $SD=0.64$). This indicates that by using a digital app to mediate the SS intervention, attitudes towards the SS intervention increases. However, this change was not statistically significant. Yet it is interesting to note that the pre-engagement attitude ratings for both mothers ($M=4.24$, $SD=0.71$, out of 5) and practitioners ($M=4.50$, $SD=0.51$, out of 5) were already relatively close to the ceiling rating. This is consistent with previous literature showing positive attitudes towards the SS intervention (Green et al., 2006; Dodd, 2008), which the current findings show extend to the digitally-mediated intervention to. The lack of statistically significant change in attitude ratings could be attributed to the fact that both potential benefits and drawbacks, of using digitally-mediated SSs, were identified by mothers and practitioners.

Mothers and practitioners reported digitally-mediated SSs to be potentially empowering. However, the answer to the question of “who is this empowering” was strikingly different. Practitioners reported that digitally-mediated SSs could empower parents by providing a supportive framework that could explicate further the process of developing and delivering the intervention. Key stakeholders, such as parents, who deliver interventions in a naturalistic context may struggle to implement interventions as intended without training, planning and support (Fallon et al., 2016). Thus, by clarifying the intervention process, digitally-mediated SSs could promote parental autonomy whilst also augmenting treatment fidelity. Such a premise was also supported by the quantitative data. Furthermore, the impact of using digitally-mediated SSs on mothers’ competence also produced a large effect-size.

Mothers reported on how digitally-mediated SSs could provide their children with the opportunity to carry out a task (i.e., to go through the social story) independently, and as a result, augment their children's "self-determination". Self-determination is defined as the ability to make decisions for oneself. Mothers who participated in this study seem to hold their children's "self-determination" in high regard. This is in line with the literature (e.g., Carter et al., 2013) that indicates that parents of children on the autism spectrum tend to prioritise the development of their child's autonomy and self-determination. The weight given to opportunities for self-determination is warranted, especially in light of the resulting increases in motivation and engagement with learning that are reported for children on the autism spectrum (Algozzine et al., 2001). Thus, it could be argued that mothers perceived digitally-mediated SSs as empowering as they considered the intervention's potential to increase opportunities for self-determination for their children.

Similar to Hanrahan et al.'s (2020) findings, parents believed that the digital medium used to develop and deliver the SS intervention tends to make the intervention more appealing to children on the autism spectrum. Mothers reported that interactive and portable devices such as smartphones and tablets are appealing for their children. Furthermore, as reported by Yee (2012), such digital tools could offer practical possibilities for children on the spectrum, especially in terms of the ease of access to the intervention, as well as flexibility and advanced capabilities of such technology.

The fact that the digitally-mediated SSs was deemed as timesaving was perceived as positive by both mothers and practitioners. The choice of which intervention parents choose for the children, and why, can be described as a "concurrent emotional and pragmatic intervention journey (Grant et al., 2016. P. 125). In this study, mothers have acknowledged the pragmatic aspects of digitally-mediated SSs whilst also highlighting the timesaving advantage they provide. Furthermore, the digital mediation empowered users whilst also rendering the intervention more efficient. Digital mediation was also reported to present with positive features, which could influence a child's motivation and level of cooperation as a result of the intervention's technological appeal.

Digital mediation also had drawbacks. The digital device's operating system (software), as well as the device itself (hardware), were elements that were reported as potential shortcomings. Some of the mothers commented on how improper functioning of one's device could lead to a child's tantrum or increased frustration, especially in instances where devices 'freeze' or stop functioning.

Practitioners highlighted how a user's poor affinity with the device itself could lead to difficulties with the development and delivery of the SS. Such an issue could be discouraging for users who present with anxiety when using technology. Furthermore, poor affinity with one's device could potentially compromise procedural integrity. Thus, the present findings highlight a general confounding issue with digitally-mediated interventions: the users' affinity with technology and the quality of their hardware. Whilst the correlation between user experience and competence was not statistically significant, the effect size was still relatively large. So, whilst digital mediation can improve intervention procedural integrity, the user's affinity with technology could be represent a potential constraint.

Interestingly, some of the mothers reported that digitally-mediated SSs could make a child feel different, or an adolescent feel childlike, particularly in a mainstream school/classroom situation. This indicates that mothers are not only pragmatic when deciding on which intervention to utilize, but also consider the social and emotional impact of that intervention on their children. This could explain the lack of improvement in the mothers' attitude ratings towards the intervention. In fact, whilst mothers valued the digital mediation of the intervention, they were concerned about the impact that such interventions could have on their children's mainstream educational experience, particularly when used exclusively with children with autism. Mothers reported that in such instances, such interventions could increase the perception of "difference" and consequently impinge upon inclusive practices and perceptions (i.e., user's feelings of being treated differently than other children).

Perceived competence ratings regarding the delivery of SS, as a result of the digital mediation of the intervention, improved significantly for mothers. This improvement was a result of a self-oriented appraisal that was achieved after developing a few digitally-mediated SSs. Thus, it could be hypothesised that further exposure to the digitally-mediated intervention could impact further perceived competence by also augmenting knowledge and skill about the intervention. This finding was also highlighted during the focus groups, where it was proposed by practitioners that digital mediation could provide a reliable framework through which mothers can develop and deliver the SS intervention. Thus, when considering the importance of competence and knowledge to procedural integrity of the intervention (Aaron et al., 2011), it can be concluded that an increase in competence, as reported by both qualitative and quantitative data, can improve procedural integrity, and consequently also influence the effectiveness of the intervention.

5. Implications

The potential for digitally-mediated SSs to impact competence ratings whilst also empowering mothers by being more autonomous has practical implications. In terms of research, the guiding structure, as well as the timesaving possibilities, of digitally-mediated SSs could contribute towards more efficient research on the effectiveness of SSs. Furthermore, mothers' enhanced competence could contribute towards targeting a major limitation in SSs research that was highlighted in numerous studies; that of poor procedural integrity (e.g., Reynhout & Carter, 2006; Kokina and Kern 2010; Styles, 2011; Test et al. 2011; Camilleri et al., 2021).

Furthermore, the potential for increased self-determination could provide children, or users on the autism spectrum, with opportunities for further empowerment. Additionally, this facet of the intervention could also have implications on participatory research designs; where the users (i.e., individuals on the autism spectrum) could develop their own digitally-mediated SS intervention. It would be interesting to investigate this possibility whilst also looking into the effectiveness of such an intervention.

Future research should investigate if the positive factors identified in this study are specific to digitally-mediated SSs or if they could be generalised to other digitally-mediated interventions. The issue of "highlighting difference" should also be further explored. As SS interventions are developed to support a child on the autism spectrum to learn a new skill and to understand and function appropriately in different social situations, such as school, it would be unfortunate if the intervention process undermined this goal. Thus, future research should investigate if digital mediation of SS intervention impacts inclusive practices and if digital mediation, of SS intervention as well as other intervention, can reduce a child's sense of being 'different'.

6. Limitations

Participants were highly engaged mothers and practitioners with good knowledge and experience of SSs. Also, the sample used for this study was relatively small, especially for the quantitative aspects of the study. This could have impacted conclusion on statistical significance. Conclusions about the statistical significance of a test is in fact heavily influenced by sample sizes. Yet, at times, statistical significance "is not sufficiently useful to be invoked as the sole criterion for evaluating the noteworthiness" of research (Thompson,

2002, p. 66). Thus, effect sizes were described to highlight practical noteworthiness whilst also enabling comparison with future studies.

Nevertheless, the external validity of the study could be strengthened in future research by sampling a larger and more representative sample. However, the aim of the study was to increase understanding of the potential strengths and benefits of a digitally-mediated SS intervention from a user's perspective: users coming from a vulnerable and underrepresented population in terms of intervention research (Fletcher-Watson et al., 2019). The mixed-method participatory design, where qualitative and quantitative data was gathered from the same participants, was utilised to contribute towards a more comprehensive understanding of this phenomenon by integrating both types of data (Creswell & Plano Clark, 2018).

In terms of generalisability, whilst the stories were not actually delivered to particular children, the majority of children being thought of by parents and practitioners were aged 5-10 with single word or simple sentence understanding'. Then again, the efficacy of the digitally-mediated SSs that were developed was not evaluated in terms of 'intervention outcomes'. However, whilst research on efficacy has been conducted (Smith et al., 2020; b; Hanrahan et al., 2020), very little is known about parents' and practitioners' attitudes and competence.

Finally, it should be noted that around 95% of the participants reported that they were proficient at using the digital device. This could account for the participants' relatively high "user-experience" rating whilst also possibly confounding outcome measures obtained from the post-engagement survey.

7. Conclusion

This study indicates that mothers and practitioners hold positive attitude towards digitally-mediated SS intervention. Developing a digitally mediated SSs significantly improves perceived competence with the intervention. The use of digitally-mediated SSs is perceived as empowering, especially for mothers, and could offer opportunities for self-determination for children on the autism spectrum. Furthermore, digitally-mediated SSs could augment mothers' ability to develop and deliver SSs and potentially impact positively procedural integrity.

Appendix A. Questionnaire Items

Attitude scale (A)

- A1 - I believe that a social story is an effective intervention for individuals with autism.
- A2 - Using social stories is a good idea.
- A3 - I consider social stories to be an adequate and appropriate intervention for children with autism.
- A4 - Social stories can be used to prepare individuals with autism for a new situation they are to encounter.
- A5 - Social stories can be used to help individuals with autism to decrease unwanted behaviours.
- A6 - Social stories can be used to help individuals with autism learn new behaviours.

Competence scale (COMP)

- C1* - I believe that social stories are difficult for me to write or create.
- C2 - I know how to create a social story.
- C3 - I am aware that there are specific instructions/directions on how to create a social story.
- C4 - I am able to identify and set the goal/target of a social story.
- C5 - I am able to structure a social story appropriately: i.e., use at least twice as many descriptive sentences as coaching sentences.
- C6* - Social stories are tools used for entertaining children and not an intervention.

User experience (UE)

- UE1 - Using the SOFA application was easy.
- UE2 - Navigating through the SOFA application was pleasant.
- UE3 - The instructions on how to use the SOFA application are clear.
- UE4 - The SOFA application is user-friendly.

**Items C1 and C6 are reverse scored.*

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