



Games for Growth: Interactive Approaches to Enhance Social Interaction in Autism

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Abstract –

The increasing prevalence of technology has made it possible to enhance the lives of those who suffer from Autism Spectrum Disorder (ASD). The effectiveness of a computer-based intervention known as customised Audio-Visual Social Story was investigated in this study. This study demonstrates how parents, schools, and therapists may lessen their assistance in helping children develop everyday communication and behavioural skills by utilising screen-based technology. The stories were created based on the specific needs of three autistic kids, who varied in age and level of communication. Although the respondents' problematic conduct was lessened overall, there was variation in the improvement.

Keywords: Autism Spectrum Disorder, Compute-based Intervention, Android-based games, Social Story, Screen-based Technology.

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I. INTRODUCTION

According to recent population estimates, autism is the developmental disease that is spreading the quickest worldwide [1]. This increase calls for an urgent effort to improve the lives of these individuals. For every kid, developing appropriate social and behavioural skills is a crucial objective. However, as seen by the challenges they encounter on a daily basis, children diagnosed with ASD are disproportionately impacted by this disability. Three domains—social communication, social relationships, and social imagination—show significant deficits in individuals with ASD [3]. Children with autism seem alone and unaware of the outer world; they find social settings perplexing. They neglect to consider how their acts or discussions affect other people [4]. They frequently joke about with those who might not find it funny; these limitations make it harder to engage in social situations. Some of them even

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regularly engage in behaviours that have the potential to be lethal. Because they prefer to think in images, researchers have discovered that people with autism have a unique interest with visuality [5,10,12]. Not only would any technology that could educate those with ASD the essential social skills, but it would also be extremely beneficial to their family.

In order to communicate with the ASD population, the first strategies were non-electronic, static, and non-changing. They employed either pointing-based (where a person points to a symbol) or exchange-based tools. Some people can now satisfy their communication demands using a personal laptop or iPad [15]. Children with ASD have been found to benefit academically from computers. Among the key elements that can support individuals on this spectrum are surroundings that are

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regulated and organised, the utilisation of interactive features, and the capacity to customise instructions.

When given computer-based guidance to acquire and modify necessary abilities, students with autism showed more drive [14]. Numerous published research have evaluated the efficacy of utilising video-based training to teach social skills to children with ASD. [9].

The children's facial recognition skills were examined using the digital images. The youngsters were given photos of both known and unfamiliar faces that had been cropped to exclude facial characteristics like hair. Their parents' faces were among the faces they recognised. Images of siblings, close relatives, and strangers were downloaded from the internet.

The youngsters are often given an engaging and predictable scenario as part of the technology-based Social Skills Intervention [16]. For them, the capacity to apply a learnt behaviour that they learned throughout the training session is a challenging challenge. The main goal of this research was to create a customised audio-visual social story and then determine whether or not this intervention might help children behave better in everyday situations. This strategy includes tasks that present a challenge to the persons in question. More information on the method is provided in this section's Methodology section.

Aims

This study has three goals in mind:

1. Creating and refining the personalised Social Stories in which the cartoon character speaks first.
2. Creating and refining the personalised Social Stories in the first person for the subject.
3. To assess the effectiveness of both schemes as a behavioural intervention by analysing them using the self-evaluated Concentration Scale and the SSRS or Test Battery.

We will address the following research topics with a focus on the three aforementioned goals:

1. Which social narrative works better?
2. Do the participants' past behaviours alter significantly as a result of our intervention?

II. PROPOSED METHODOLOGY

Ethics statement

"All procedures carried out in studies involving human participants were compliant with the Helsinki Declaration of 1964, its subsequent amendments, or comparable ethical standards, as well as the ethical standards of the institutional and/or national research committee." "All individual participants whose identifying information is included in this article have provided additional informed consent." "Every individual participant included in the study provided informed consent."

Participants

In this study, three teenagers with ASD, ages 8 to 10, took part (see Table 1). The Soch Foundation, which offers counselling and training to persons with ASD, was used to find participants with ASD. The revised version of the Wechsler Intelligence Scale for Adults (WAIS-R) Polish adaptation was employed to determine each person's IQ. The participants in the experiment had a clinical diagnosis of ASD established by psychiatrists prior to the trial, which was confirmed by means of the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R).

Eligibility was verified using the DSM-V. The subjects' eyesight was either normal or corrected to normal. They participated in a five-hour programme five days a week during the period of the research. Every research session was held in a calm treatment room within the centre, and occasionally at the participants' homes. To establish a baseline of the particular conduct, firsthand observations and interviews with the participant's mother and the educationalist provided the first information about the participant's behaviour throughout the activities. The precise subject and content for creating the social tale were then determined using this data.

Table 1: Information of Participants

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Subject	Age (in years)	Expressive language	Attention to task, materials or teachers
Subject 1	6	Appropriate	Yes
Subject 2	5	Limited	Yes
Subject 3	4	Poor	No

Stimuli and Apparatus

PowerPoint presentations containing social anecdotes were employed as stimulants. Social Stories are individualised, factually correct narratives that are supported by text and images for meaning and clarity [8]. To rule out any variations between stimuli, the brightness of each image was matched to the colour statistics of a single image. The facial stimuli varied in size from 6X60 to 6X50. It was created using the Social Story formula and the standards suggested by Grey [7]. Table 2 displays the text that was utilised in one of the Social Stories in accordance with Gray's recommendations. Table 2: Texts Used in Subject 1's Social Story

Slide Number	Text
1.	<i>With whom can Subject 1 laugh</i>
2.	<i>Subject 1 likes to talk and laugh with people</i>
3.	<i>It's OK</i>
4.	<i>I can laugh with my family. They like my joking</i>
5.	<i>I can try to talk to friends and teachers</i>
6.	<i>I can tell them what I had today and yesterday</i>
7.	<i>This will make me and mumma happy</i>

The individuals were photographed with an iPhone 4s in a range of situations that reflected the desired conduct and focal point of the social story. The initial author loaded the photos, audio narration, and Social Story. As the main design platform, Microsoft PowerPoint is used to develop screen-based activities. For our study,

social tales were developed using pictures that told a story and audio recordings that included character dialogue. Specifically, a number of pictures telling the tale of the talent had a toy figure, home stairs, a room, a few pals, and a mother all posed together. There were two types of presentations made:

- In which the subject's face was superimposed over the toy figure
 - With a cartoon character's face superimposed
- Since none of the participants in the subject's Individualised Education Plan (IEP) had ever been exposed to watching videos, video modelling was not included in our study. As a result, the abrupt introduction of moving and animated graphics might provoke tantrums. Therefore, before adding anything new to the schedules of the children at the facility, it is imperative that one has a basic understanding of the treatments and training techniques that are being employed.

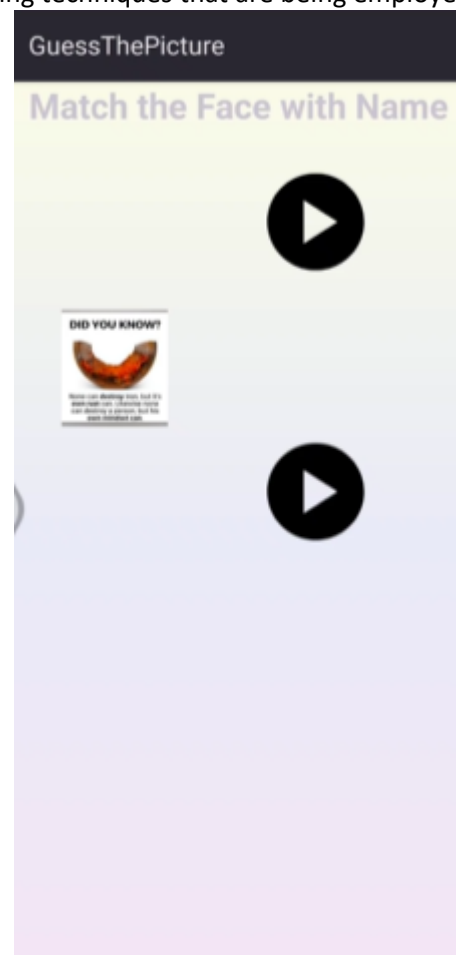


Figure 1 Screenshot of Presentation with Subject's Face

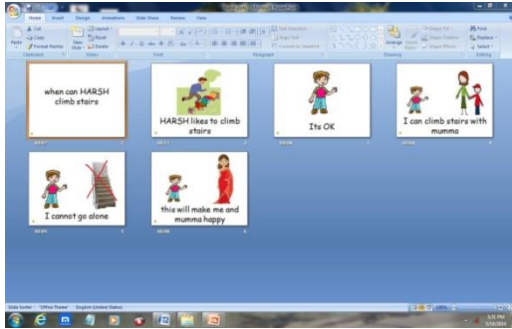


Figure 2: Screenshot of Presentation with Cartoon Character's Face

Screenshots of the presentations with a subject and a cartoon character, respectively, are shown in Figures 1 and 2. The purpose of this exploratory study was to see whether showing a Social Story on an iPad, laptop, or computer may improve the on-task behaviours of participants with autism. It was anticipated that the Social Story, which was displayed on the screen, would help the child's focus and conduct. Depending on the topic at hand, we have worked on two distinct visual presentations in this study, each with unique circumstances and attributes. Our primary goal was to gauge a shift in the desired behaviour or social competence.

FaceID was a brightly coloured, two-game Android-based gaming intervention. The main objective of these activities was to improve the kids' face recognition memory and teach them how to identify faces. aimed at

The goal of the original game, FaceMatch, was to match the well-known faces. Face album was made using the phone gallery and tablet camera. The photos of the familiar faces were obtained (individually) from the families of children with ASD, which were the same as they were prior to the intervention. Level 1 begins with just one recognisable face appearing in the left corner of the screen, which must be dragged and dropped to match the identical face in the right corner of the screen. The selections on the right side of the screen expand as the level goes on.

level 2 of the game requires the player to drag and drop a face from the left side of the screen to match a corresponding face from the right side of the screen from three available alternatives. The display honours the kid by showing the

photo with the happy face if the youngster matches the proper face and the sad face if the match is wrong.

The purpose of the second game, "EnMem," was to improve the child's mental capacity for facial recall. The young person was asked to recall the appropriate face that would go with the other faces of the various cards that were shown on the screen. Once

matching caused that specific face to vanish from the screen while the other faces stayed there. Repeat these actions until none of the cards remain on the screen.

Facial recognition and memorization were examples of social skills. The parents requested that this game (intervention) be created because the majority of previously designed interventions catered only to the needs of the western population and did not offer any customizability features like voice recording and image browsing.

Procedure

Baseline (pre-intervention), iPad-presented social narrative intervention, and withdrawal from intervention (post-intervention) were the three stages of the study. When the kid successfully finished a session of intervention, the mother or the therapist would verbally congratulate them. This type of reinforcement was also offered throughout the post-intervention phase when the subject behaved well.

a) Pre-Intervention Phase: Over the course of 12 weeks, direct observations and interviews with the participant's mother and the educationalist provided preliminary information on the participant's behaviour during activities. This information was used to determine the precise topic and wording for creating the social tale. Given that children from a variety of disadvantaged backgrounds were enrolled in the autism centre, language barriers were a reason for worry.

The pre-intervention block diagram is shown in Figure 4. Thus, the pre-recorded narrative of the story was in:

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- English for Subject 1
- Hindi for Subject 2 and Subject 3

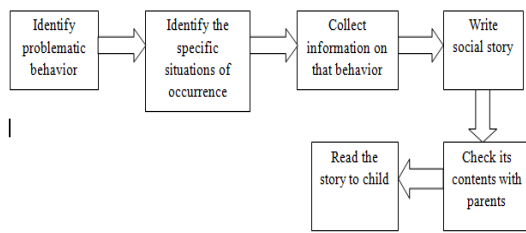


Figure 4: Flowchart for Baseline Intervention

a) Intervention Phase: For four weeks, the moms of each child or the therapist led the sessions, which lasted around seven minutes each. Every day, there were four sessions. A morning session was held from 11.30 a.m. until 12.30 a.m. Setting up the teaching area at a table and configuring the presentation on the laptop or iPad were part of the preparation for the session. The setup for the intervention phase is depicted in Figure 5.

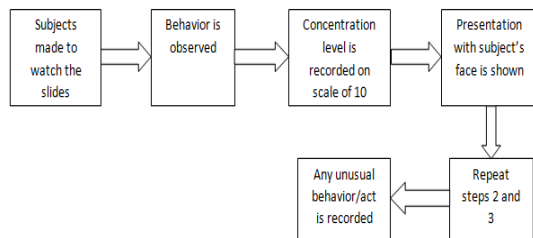


Figure 5: Flowchart for Steps followed During Intervention

b) Post-Intervention Phase: A two-week period was used to examine the child's conduct in unaltered environments. The actions listed below were taken to examine the conduct and determine how successful the two distinct presentations were, as seen in figure 6.

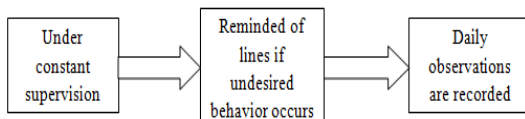


Figure 6: Flowchart for Steps followed Post-Intervention

III. Results

The Social Skills Rating System (SSRS) was used to analyse the individuals [6]. This evaluation

instrument will assist in evaluating and investigating the social skill intervention's possible value for individuals with ASD. However, instructors find it challenging to use SSRS. As a result, we were able to evaluate the participants using the "Concentration Scale," a self-evaluation tool, in addition to the SSRS. In these circumstances, values ranging from 0 to 10 were taken into account and utilised to compute the Improved Rate Difference (IRD) in order to achieve the desired improvement.

Evaluation was done in the following areas:

- Retention: we retain pictures we view, refer to them when necessary, and replicate actions.
- Reproduction: images become actions when abilities are inside our repertory.
 - Attention: attention improves when the model looks more like self.
- Motivation: Imitation happens for a purpose.

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Inter-Observer Trustworthiness

All of the sessions over the three stages of our method were rated by the mother and the first author. For one session every day, the concentration level was noted.

Examination

The data for the target behaviours was graphed, visually examined, and then numerically analysed as indicated in figure 7 to ascertain behavioural changes between baseline and intervention (i.e., instruction and priming phases). The imagined scenario will make use of the Concentration Scale.

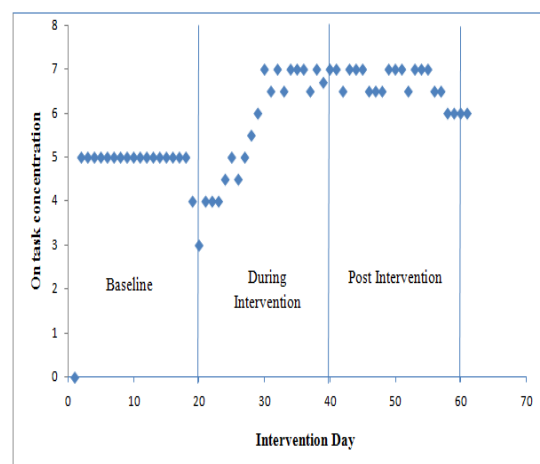


Figure 7: Subject 1: Concentration Level of on-task behaviour using Cartoon Character's face
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and Subject’s face as the first person during baseline, intervention and verification.

Following the social narrative intervention, there were notable gains on the subscales measuring social skills and adaptive conduct.

IRD was computed in two methods:

- Determining the phase average for each of the three phases independently.
- Determining the overall mean of all scores throughout all phases.

$$\text{Mean IRD for each phase is} = \frac{\text{Sum of scores from Concentration Scale}}{\text{Total number of scores}}$$

$$\text{Mean IRD for all phases collectively is} = \frac{\text{Sum of all scores from Concentration Scale}}{\text{Total number of scores}}$$

$$\text{(Improvement rate Percentage is} = \frac{\text{Difference of mean IRD values of phase 3 and 1}}{\text{Mean IRD value of phase 1}} \times 100$$

Subject 3 did not show improvement throughout an intervention, but his data were not taken into consideration because of his habitual non-compliance, which was thought to be a sign that he was not sensitive to this specific intervention.

Table 3: Analysis of Subject 1’s Graphed Data across Phase

PHASE	ANALYSIS
BASELINE	Stable, slightly downward trend
	No variability
	Mean IRD 4.6
INTERVENTION	Upward trend
	Relatively large variability
	Mean IRD 5.9
WITHDRAWAL OF INTERVENTION	Stable trend
	Smaller variability
	Mean IRD 6.8

Subject 1 showed a 48% improvement rate from baseline to the Intervention stages of the technique employed to instill the targeted social skill, with an overall mean IRD for the three phases under examination of 5.8. Additionally, this demonstrated a sharper focus throughout

the presentation that highlighted the subject's face. Subject 2 also demonstrated a 30% improvement rate.

IV. Conclusion

Subject 1 displayed a significant improvement, whereas another subject exhibited a slight improvement. As a result, this research increases the effectiveness of telling social stories to young autistic children that include the subject's face. It also sheds light on whether iPads or other screen-based technologies are practical for use as intervention tools. As a result, visual approaches are among the most effective ways to teach these autistic children since they give detailed descriptions of material while also offering a visual depiction (such as pictures, sketches, etc.) of the abilities being taught. In order to help these unique and difficult children learn and comprehend better, this method should unquestionably be implemented in autism training institutes.

Children with ASD frequently struggle with skill maintenance; if a skill is not regularly utilised in everyday life or exercised, it may "lose" in the child's mind. Thus, in order to prevent the kid from losing the previous abilities, new ideas should be presented once a student has mastered a particular skill within a programme, and mastered concepts should be revisited on a regular basis.

We may infer that when practitioners take into account the age, language proficiency, and cognitive capacity of the student for whom the narrative is being produced, visual social stories and android based game have the potential to be effective treatments. Compared to other approaches, Android-based games and visual social storytelling are more effective for children with ADS.

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