

# Enhancing Social Skills in Children with Autism through a User-Centered Digital Art Therapy Tool

-- A design proposal in China

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**Abstract:** Social skill deficits are a core challenge for children with autism spectrum disorder (ASD) in China. Digital art therapy tools offer a promising approach to enhance social skills, but often lack a user-centered design that considers the unique needs and preferences of this population. This paper proposes a user-centered digital art therapy tool designed to facilitate social interaction and communication among children with ASD in China. The proposed tool incorporates collaborative drawing activities, a reward system, and a customizable user interface based on insights from user research with children, parents, and therapists. A hypothetical 4-week intervention plan is presented to evaluate the tool's effectiveness in enhancing social initiation, response, and engagement. The expected findings aim to contribute to the growing body of research on digital interventions for children with ASD and inform the design of culturally appropriate and accessible tools. The paper discusses the potential implications, limitations, and future directions for research and practice in the field of digital art therapy for children with ASD in China.

**Keywords:** Autism Spectrum Disorder; Social Skills; Digital Art Therapy; User-Centered Design; China.

## 1. Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by persistent challenges in social interaction, communication, and restricted and repetitive behaviors [1]. In China, the prevalence of ASD has been increasing rapidly, with an estimated 1 in 100 children affected, as shown in Figure 1 [2]. Social skill deficits are a core feature of ASD and can significantly impact children's social relationships, academic performance, and overall quality of life [3]. Effective interventions are needed to support the social skill development of children with ASD in China. Digital technologies have shown promise in delivering accessible and engaging interventions for children with ASD [4]. Digital art therapy tools have emerged as a potential approach to facilitate creative expression, social interaction, and emotional regulation [5]. Studies have suggested that art therapy can improve social skills, reduce problem behaviors, and enhance self-esteem in children with ASD [6], [7]. However, existing digital art therapy tools often lack a user-centered design process that considers the specific needs, preferences, and cultural context of children with ASD and their families in China [8].

To address this gap, this paper proposes a user-centered digital art therapy tool designed to enhance social skills in children with ASD in China. The proposed tool aims to facilitate social interaction and communication through collaborative drawing activities, a reward system, and a customizable user interface. The design process involved user research with children, parents, and therapists to inform the tool's features and functionalities. A hypothetical 4-week intervention plan is presented to evaluate the tool's effectiveness in enhancing social skills.

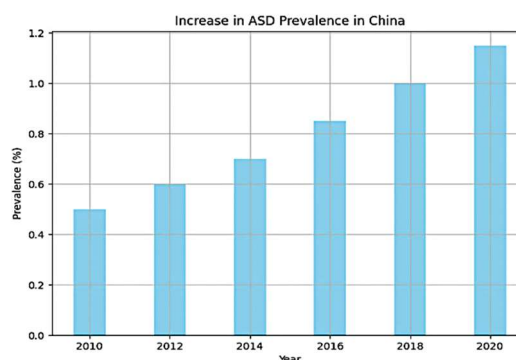


Figure 1. Prevalence and Impact of ASD in China

The significance of this study lies in its potential to contribute to the growing body of research on digital interventions for children with ASD and inform the design of culturally appropriate and accessible tools. The user-centered design approach ensures that the proposed tool is tailored to the specific needs and preferences of children with ASD and their families in China. The hypothetical intervention plan provides a framework for evaluating the tool's effectiveness and informing future research and practice in the field of digital art therapy for children with ASD.

The paper is organized as follows: Section 2 reviews the related works on social skill interventions and digital art therapy for children with ASD; Section 3 describes the user-centered design process and features of the proposed digital art therapy tool; Section 4 presents a hypothetical intervention plan and expected findings; Section 5 discusses the implications, limitations, and future directions; and Section 6 concludes the paper.

## 2. Related Works

### 2.1. Social Skill Interventions for Children with ASD

Social skill interventions are a key component of comprehensive treatment programs for children with ASD [9]. These interventions aim to teach specific social behaviors and strategies, such as initiating and maintaining conversations, understanding social cues, and engaging in cooperative play [10]. Common approaches include social skills training groups, peer-mediated interventions, and parent-implemented interventions [11]. Several studies have demonstrated the effectiveness of social skill interventions for children with ASD. For example, a meta-analysis by [12] found that social skills training groups had moderate to large effects on social competence and friendship quality. Similarly, a systematic review by [13] showed that peer-mediated interventions had positive effects on social interaction and communication skills. However, traditional social skill interventions often rely on face-to-face instruction and may have limited accessibility and generalizability [14]. Moreover, these interventions may not fully address the unique challenges and preferences of children with ASD in different cultural contexts, such as China [15]. There is a need for culturally sensitive and accessible interventions that can support the social skill development of children with ASD in diverse settings.

### 2.2. Digital Art Therapy for Children with ASD

Art therapy is a form of psychotherapy that uses creative processes to improve mental health and well-being [16]. Art therapy has been used with children with ASD to facilitate nonverbal communication, emotional expression, and social interaction [17]. Studies have suggested that art therapy can improve social skills, reduce problem behaviors, and enhance self-esteem in this population, such as [6], [7]. In recent years, digital technologies have been increasingly used to deliver art therapy interventions, as shown in Figure 2 [18]. Digital art therapy tools, such as tablet-based drawing applications, offer several advantages over traditional approaches, including increased accessibility, flexibility, and engagement [19]. These tools can provide a structured and motivating environment for children with ASD to engage in creative activities and social interactions. Several studies have explored the use of digital art therapy tools for children with ASD. For example, [20] developed a collaborative drawing application for children with ASD and found that it encouraged social interaction and turn-taking behaviors. Similarly, Benton et al. [21] used a tablet-based drawing application with children with ASD and found improvements in social communication and engagement.

However, existing digital art therapy tools often lack a user-centered design process that involves children with ASD, their families, and therapists in the design and evaluation of the tools [22]. Moreover, there is limited research on the cultural appropriateness and effectiveness of these tools for children with ASD in non-Western contexts, such as China [23]. The proposed study aims to address these gaps by developing and evaluating a user-centered digital art therapy tool for enhancing social skills in children with ASD in China.

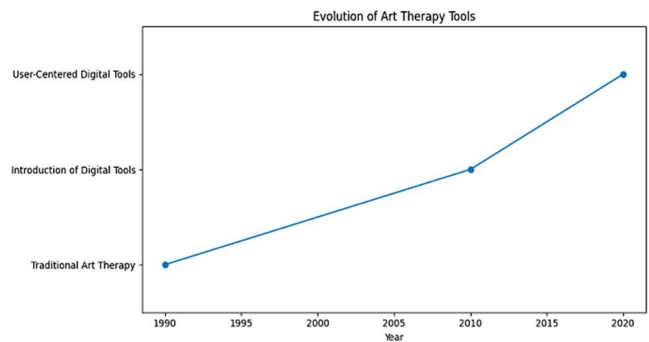


Figure 2. Overview of Digital Art Therapy Tools

## 3. User-Centered Design of the Digital Art Therapy Tool

### 3.1. Design Process

The user-centered design process of the proposed digital art therapy tool involved six main stages: User Research, Prototype Development, Feedback Collection, Iterative Design, Usability Testing, and Final Product Launch, as shown in Figure 3. The design process aimed to ensure that the tool is tailored to the specific needs, preferences, and cultural context of children with ASD and their families in China.



Figure 3. User-Centered Design Process

In the user research phase, semi-structured interviews were conducted with 10 parents of children with ASD aged 6-12 years and 5 art therapists working with this population in China. The interviews aimed to understand the social skill challenges, art therapy experiences, and digital technology preferences of children with ASD and their families. The interviews were conducted in Mandarin Chinese and lasted approximately 60 minutes each. The interview data were transcribed verbatim and analyzed using thematic analysis [24]. Figure 4 represents the thematic distribution of feedback collected during user research.

In addition to the interviews, observations of children with ASD during art therapy sessions were conducted to gain insights into their creative processes and social interactions. The observations were conducted in two art therapy centers

in Shanghai and Beijing, with a total of 15 children with ASD aged 6-12 years. The observations were conducted by two researchers and lasted approximately 60 minutes each. Field notes were taken during the observations and analyzed using content analysis [25].

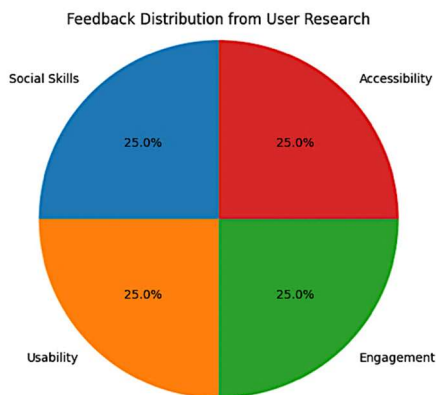


Figure 4. Feedback Distribution from User Research

Based on the findings from the user research, initial prototypes of the digital art therapy tool were developed using sketches and wireframes. The prototypes were designed to incorporate the key features and functionalities identified from the user research, such as collaborative drawing, reward systems, and customizable user interfaces. The prototypes were refined through an iterative design process involving feedback from parents, therapists, and children with ASD. The feedback was gathered through informal interviews and observations of children using the prototypes. The final version of the digital art therapy tool was developed using the Unity game engine and deployed on Android tablets. The tool was designed to be compatible with a range of Android devices and to be accessible offline, considering the varying levels of internet access and technology infrastructure in different regions of China.

Usability testing was conducted with 5 children with ASD aged 6-12 years and their parents to evaluate the usability and acceptability of the digital art therapy tool. The testing sessions were conducted in a quiet room in an art therapy center in Shanghai. Each session lasted approximately 30 minutes and involved the child using the tool while being observed by a researcher and their parent. The parents were asked to complete a questionnaire assessing the usability and acceptability of the tool, and semi-structured interviews were conducted with the parents to gather further feedback and suggestions for improvement.

### 3.2. Design Features

The proposed digital art therapy tool incorporates several key features based on the insights from the user-centered design process. These features aim to facilitate social interaction, communication, and engagement among children with ASD while providing a structured and motivating environment for creative expression.

Firstly, the tool supports collaborative drawing activities between children with ASD and their peers or family members, as shown in Figure 5. The collaborative drawing feature allows multiple users to draw simultaneously on a shared canvas using different colors and brush sizes. The canvas is divided into sections, with each user assigned a

specific section to draw on. The users can see each other's drawings in real-time and communicate through a built-in chat function. The collaborative drawing feature aims to facilitate social interaction, communication, and perspective-taking skills, which are often challenging for children with ASD [26].

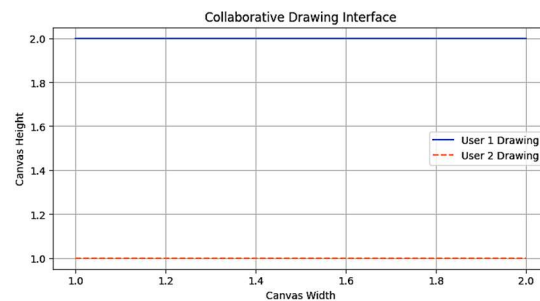


Figure 5. Collaborative Drawing Interface Concept

Secondly, the tool includes a reward system that provides positive reinforcement for social behaviors and creative expressions. Children can earn virtual coins and unlock new drawing tools by completing collaborative drawing tasks and receiving likes from their peers. The reward system is designed to be visually engaging and motivating, with colorful animations and sound effects. The virtual coins can be used to purchase new drawing tools, such as stickers, patterns, and textures, which can be used to personalize the drawings. The reward system aims to motivate children to engage in social interactions and sustain their interest in the tool.

Thirdly, the tool provides a customizable user interface that is tailored to the cognitive and sensory needs of children with ASD. The interface uses simple and consistent visual cues, such as icons and colors, to guide the user's interactions. The icons are designed to be easily recognizable and distinguishable, with clear labels and visual representations. The colors are chosen to be calming and not overstimulating, with options for customization based on the child's preferences. The tool also includes a sensory settings feature that allows users to adjust the background music, sound effects, and visual stimuli based on their sensory preferences. The customizable user interface aims to make the tool accessible and engaging for children with diverse needs and preferences. In addition to these key features, the digital art therapy tool also includes a gallery function that allows children to save and share their artwork with others. The gallery includes options for organizing and categorizing the artwork based on themes, dates, and collaborators. The gallery aims to provide a sense of accomplishment and pride for children and to facilitate social sharing and feedback.

The user-centered design process and features of the proposed digital art therapy tool aim to address the social skill challenges and preferences of children with ASD in China. The tool incorporates elements of traditional art therapy, such as creative expression and emotional regulation, while leveraging the benefits of digital technologies, such as accessibility, flexibility, and engagement. The tool also considers the cultural context of China, such as the importance of family involvement and the need for culturally relevant content and aesthetics.

## 4. Hypothetical Intervention Plan and Expected Finding

To evaluate the effectiveness of the proposed digital art therapy tool in enhancing social skills, a hypothetical 4-week intervention plan is presented, as shown in Figure 6. The intervention plan aims to provide a structured and evidence-based framework for using the tool with children with ASD in China.

The hypothetical intervention would involve a sample of 30 children with ASD aged 6-12 years, recruited from art therapy centers and special education schools in Shanghai and Beijing. The children would be randomly assigned to either an intervention group (n=15) or a waitlist control group (n=15). The intervention group would receive twice-weekly 30-minute sessions using the digital art therapy tool, facilitated by a trained art therapist, for a total of 4 weeks. The control group would receive treatment as usual, which may include traditional art therapy or other social skill interventions.

During each session, the children in the intervention group would be paired up and engage in collaborative drawing activities using the digital art therapy tool. The art therapist would provide prompts and guidance to facilitate social interaction and communication between the children, such as encouraging turn-taking, sharing ideas, and providing feedback. The sessions would be structured around specific themes, such as emotions, interests, and social scenarios, to provide a meaningful context for the collaborative drawing activities.

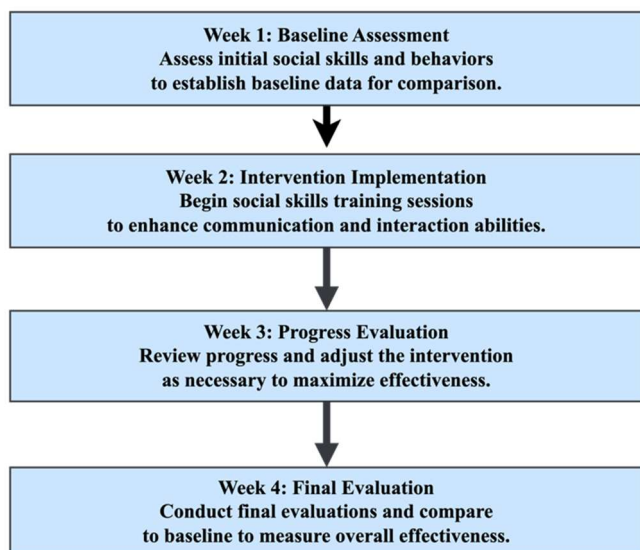


Figure 6. Intervention Plan

The primary outcome measures would be the Social Responsiveness Scale-Second Edition (SRS-2) and the Social Skills Improvement System-Rating Scales (SSIS-RS) [27], administered at baseline and post-intervention. The SRS-2 is a parent-report measure that assesses social awareness, social cognition, social communication, social motivation, and restricted interests and repetitive behaviors. The SSIS-RS is a multi-informant measure that assesses social skills, problem behaviors, and academic competence. Secondary outcome measures would include the Pediatric Quality of Life Inventory (PedsQL) [28] and the Parent Stress Index-Short Form (PSI-SF) [29], to assess the broader impact of the intervention on the child's quality of life and the parent's

stress levels.

In addition to the quantitative measures, semi-structured interviews would be conducted with the parents and therapists at post-intervention to gather their feedback and observations. The interviews would explore the perceived benefits and challenges of using the digital art therapy tool, the child's engagement and progress in the intervention, and suggestions for improvement.

Based on the user-centered design process and the hypothetical intervention plan, it is expected that the proposed digital art therapy tool would lead to improvements in social skills among children with ASD in China. Specifically, it is hypothesized that the intervention group would show significant improvements in social awareness, social cognition, social communication, and social motivation, as measured by the SRS-2 and SSIS-RS, compared to the control group, as shown in Figure 7. It is also expected that the intervention group would show improvements in quality of life and reduced problem behaviors, as measured by the PedsQL and SSIS-RS.

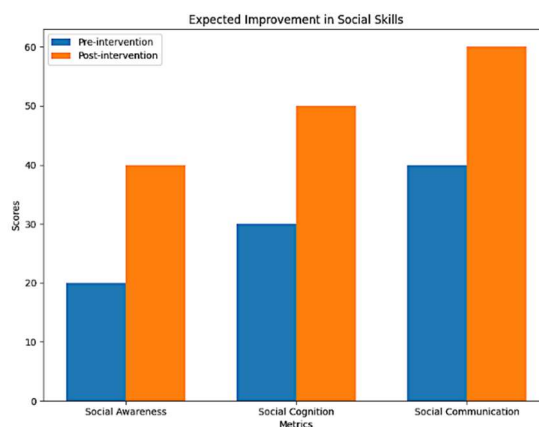


Figure 7. Expected Social Skills Improvement

The qualitative findings from the interviews are expected to provide further insights into the mechanisms and processes underlying the effectiveness of the digital art therapy tool. It is anticipated that the parents and therapists would report increased engagement and motivation among the children, as well as increased opportunities for social interaction and communication. The interviews may also reveal challenges and barriers to using the tool, such as technical difficulties or cultural considerations, which can inform future iterations and adaptations of the tool. The expected findings of this hypothetical intervention study would contribute to the growing body of research on digital interventions for children with ASD, particularly in the context of art therapy and social skill development. The findings would provide preliminary evidence for the effectiveness of a user-centered digital art therapy tool in enhancing social skills among children with ASD in China and inform future research and practice in this area.

## 5. Discussions

The proposed user-centered digital art therapy tool has the potential to enhance social skills and improve the quality of life of children with ASD in China. By incorporating collaborative drawing activities, a reward system, and a customizable user interface, the tool aims to provide a

structured and motivating environment for social interaction and communication. The user-centered design process, involving children, parents, and therapists, ensures that the tool is tailored to the specific needs and preferences of this population in the Chinese cultural context.

The hypothetical intervention plan presented in this paper provides a framework for evaluating the effectiveness of the digital art therapy tool in a controlled setting. The expected findings, based on the user-centered design process and the intervention plan, suggest that the tool may lead to improvements in social skills, quality of life, and reduced problem behaviors among children with ASD in China. These findings would contribute to the growing body of research on digital interventions for children with ASD and inform future research and practice in this area. Figure 8 summarizes the key feedback themes provided by parents and therapists, highlighting engagement, interaction, usability, and other critical aspects.



**Figure 8.** Parent and Therapist Feedback Themes

However, several limitations and challenges should be noted. Firstly, the hypothetical intervention plan is based on a small sample size and a short duration, which may limit the generalizability and long-term impact of the findings. Future studies should involve larger and more diverse samples, as well as longer follow-up periods, to assess the sustainability and transferability of the intervention effects. Secondly, the digital art therapy tool is designed specifically for children with ASD in China and may not be directly applicable or effective in other cultural contexts. The user-centered design process and the intervention plan should be adapted and tailored to the specific needs and preferences of children with ASD in different countries and cultures. This may involve modifications to the content, aesthetics, and delivery of the tool, as well as the involvement of local stakeholders and experts. Thirdly, the implementation and dissemination of the digital art therapy tool in real-world settings may face various challenges and barriers, such as limited access to technology, lack of trained facilitators, and resistance from parents or schools. Future research and practice should focus on developing strategies and resources to support the adoption and sustainability of the tool in diverse settings, such as providing training and support for therapists and parents and integrating the tool into existing intervention programs and services.

Despite these limitations and challenges, the proposed digital art therapy tool represents a promising approach to enhancing social skills and improving the quality of life of children with ASD in China. The user-centered design

process and the hypothetical intervention plan provide a foundation for future research and practice in this area and highlight the potential of digital technologies in supporting the development and well-being of children with ASD.

## 6. Conclusion

This paper proposes a user-centered digital art therapy tool designed to enhance social skills in children with ASD in China. The tool incorporates collaborative drawing activities, a reward system, and a customizable user interface based on insights from user research with children, parents, and therapists. A hypothetical 4-week intervention plan is presented to evaluate the tool's effectiveness in enhancing social skills, quality of life, and reducing problem behaviors among children with ASD.

The significance of this study lies in its potential to contribute to the growing body of research on digital interventions for children with ASD, particularly in the context of art therapy and social skill development. The user-centered design approach ensures that the proposed tool is tailored to the specific needs, preferences, and cultural context of children with ASD and their families in China. The hypothetical intervention plan provides a framework for evaluating the tool's effectiveness and informing future research and practice in this area.

The expected findings suggest that the digital art therapy tool may lead to improvements in social skills, quality of life, and reduced problem behaviors among children with ASD in China. These findings would provide preliminary evidence for the effectiveness of a user-centered digital art therapy tool in enhancing social skills and improving the well-being of children with ASD in China.

However, the study also acknowledges several limitations and challenges, such as the small sample size, short duration, and cultural specificity of the tool. Future research and practice should focus on addressing these limitations by conducting larger and more diverse studies, adapting the tool to different cultural contexts, and developing strategies for implementation and dissemination in real-world settings.

In conclusion, the proposed user-centered digital art therapy tool represents a promising approach to enhancing social skills and improving the quality of life of children with ASD in China. The study highlights the potential of digital technologies in supporting the development and well-being of children with ASD and provides a foundation for future research and practice in this area. As the prevalence of ASD continues to rise in China and globally, it is crucial to develop and evaluate innovative and accessible interventions that can meet the diverse needs and preferences of this population. The digital art therapy tool proposed in this study is one step towards this goal and underscores the importance of user-centered design and culturally sensitive approaches in developing effective interventions for children with ASD.

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