

AI-Augmented Social Skills Training for Urban Indian Adolescents with Autism : Challenges and Innovations

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Abstract

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- Implementation Challenges

Background: Social Skills Training (SST) is essential for adolescents with autism spectrum disorder (ASD) to improve social communication and peer interactions, particularly during the critical transition to adulthood. In urban India, access to specialized SST programs remains limited due to social stigma, resource constraints, and infrastructural challenges. Artificial Intelligence (AI) offers innovative opportunities to augment SST through personalized, scalable, and engaging tools such as emotion recognition software, virtual reality (VR) simulations, and AI-generated social narratives.

Methods: This narrative review critically examines AI-augmented SST interventions relevant to urban Indian adolescents with ASD, focusing on cultural adaptation, barriers to implementation, and future directions. A comprehensive literature search was conducted using PubMed, Scopus, Web of Science, and Cochrane Library databases, filtering for Indian studies published between 2013 and 2025. Selected high-quality peer-reviewed articles were critically appraised and synthesized thematically.

Results: Key findings highlight AI's potential to complement traditional SST approaches while emphasizing challenges such as cultural diversity, digital access disparities, therapist training gaps, and data privacy concerns.

Conclusion: This review proposes a framework for integrating AI into ASD social interventions in urban India, advocating multisectoral collaboration to overcome barriers and optimize outcomes. Realizing these benefits requires culturally tailored tools, robust infrastructure, and stringent attention to privacy and ethics along with professional therapists and family involvement, with AI functioning as a supportive adjunct.

1. Introduction

Autism Spectrum Disorder (ASD) presents with persistent difficulties in social communication and interaction, along with restricted and repetitive behaviours and interests^[1]. During adolescence, these individuals go through a critical developmental window where the social demands intensify, and many of them continue to have challenges in peer relationships and emotional regulation^[2]. In urban India, adolescents with ASD face multiple barriers including delayed diagnosis, limited specialized social skills training (SST), and pervasive social stigma^[3], which limit access to effective social interventions.

Traditional SST programs focusing on conversational skills, perspective-taking, and emotion recognition have shown efficacy globally, but implementation challenges in India, such as shortages of trained therapists, inconsistent program delivery, and lack of cultural adaptation, reduce effectiveness^[4]. Recent advancements in Artificial Intelligence (AI), including facial emotion recognition software, virtual reality (VR) social simulations, and AI-generated personalized social narratives, offer scalable, engaging, and individualized support that can address resource constraints and improve intervention outcomes^[5].

This review aims to critically analyse the current evidence on AI-augmented SST interventions targeting adolescents with ASD in urban India, considering cultural adaptation, implementation barriers, and enablers. It also proposes strategies to integrate AI into ASD social intervention frameworks tailored to the Indian context.

2. Methods

A comprehensive narrative review was conducted following a structured search of PubMed, Scopus, Web of Science, and Cochrane Library databases. Search terms combined keywords and MeSH terms such as (“autism spectrum disorder” OR “ASD”) AND (“Social Skills Training” OR “SST”) AND (“Artificial Intelligence” OR “AI”) AND (“India” OR “urban India”) AND (“adolescents” OR “teenagers”).

Articles included peer-reviewed empirical studies, systematic reviews, and feasibility studies published from 2013 to 2025 that focused on AI tools in SST for adolescents (aged 10–18 years) with ASD, or studies addressing culturally relevant adaptations in urban Indian settings. Non-English publications, preprints, studies in children under 10 or adults over 18, and studies without AI or SST focus were excluded.

Initial screening involved title and abstract review of 230 articles in PubMed, extracted in CSV format and analysed with Rayyan for screening and deduplication. Data were extracted in Excel. Full-text appraisal followed. Studies were critically evaluated for methodological rigor, sample size adequacy, and relevance to the Indian urban adolescent ASD population. Data were synthesized into thematic domains: traditional SST approaches, AI augmentation techniques, cultural adaptation, implementation barriers, and facilitators. Findings were narratively synthesized with critical analysis.

3. Results

3.1 Traditional Social Skills Training Approaches in India

Conventional SST methods in India primarily employ social stories, role-play, peer modelling, and video modelling. Social stories, made with personalized narratives illustrating social scenarios and expected responses, were culturally adapted to reflect Indian familial respect norms and indirect communication styles^[4,6]. Peer-mediated interventions in educational settings are becoming more common, but widespread implementation is limited by non-availability of adequate therapists and inconsistencies in training quality^[7].

Systematic reviews highlight that parent-mediated and developmental approaches are feasible but under-researched and inconsistently integrated into mainstream education^[8,9]. The scarcity of published literature and gaps in infrastructure underscore the need for localized curriculum adaptation and resource allocation^[8,9]. Balancing technological interventions with family-centred strategies is emphasized as critical for sustainability in resource-

poor contexts^[8,9]. Although positive outcomes have been documented, studies consistently emphasize the need for deeper localization of SST content to align with India's socio-cultural diversity. Integration of SST into mainstream educational and community programs remains limited, thereby hindering accessibility and long-term sustainability^[8,9].

3.2 AI-Augmented Social Skills Training Tools (Table no.1)

AI technologies enhance SST by boosting engagement, personalizing learning trajectories, and providing real-time feedback^[5,9].

Table 1. Overview of AI Modalities in Social Skills Training for Adolescents with ASD in Urban India

AI Modality	Description	Benefits	Evidence in Indian Context
Emotion Recognition	Software analysing facial/vocal cues	Facilitates emotion recognition; provides real-time feedback	Feasibility and usability of AI-based emotion recognition systems, with improvement in emotion identification skills, supported by Indian and global studies ^[7,11,12,13]
Virtual Reality (VR)	Immersive social simulations	Safe environments for social practice; customizable difficulty	Emerging evidence from Indian and global studies indicates improvement in social responsiveness using VR-based interventions ^[14,15,16]
AI-Generated Social Stories	Automated culturally tailored narratives	Increases personalization; reduces therapist workload	Acceptance studies demonstrated feasibility and engagement ^[17,18]
Mobile Apps and Chatbots	AI-driven interactive coaching and gamified modules	Enhances accessibility and practice scalability	Indian pilot apps demonstrated usability and engagement in urban adolescents with ASD ^[19,20,21]

These AI-enabled tools complement traditional SST by addressing therapist shortages and enabling individualized, flexible learning pathways. Electronic assessment tools (e.g., VB-MAPP) and web-based curricula tailored to Indian cultural and linguistic contexts are promising enablers⁴.

International work further emphasizes robotics and AI integration, though concerns remain regarding algorithmic bias, data privacy, and reduced human interaction^[22,23].

Efficacy depends on culturally sensitive design, vernacular language integration, and clinical alignment^[22,23].

3.3 Barriers to Implementation in Urban India

Despite promising advances, several barriers hinder widespread adoption of AI-augmented SST in urban India:

- **Stigma and awareness:** Persistent social stigma surrounding autism and limited awareness of AI-based tools restrict therapy uptake.^[24,25]
- **Training and acceptance:** Therapists and educators often lack exposure to AI technologies and express concerns regarding depersonalization of therapy.^[7,23]
- **Infrastructure and technology access gap:** Unequal access to smartphones, reliable

internet, and digital literacy impedes consistent tool use^[26,27]

- **Cultural and linguistic diversity:** India's vast heterogeneity necessitates tailored AI content to ensure relevance and inclusivity^[8,16,22]
- **Limited cultural adaptation of Western models:** SST programs developed in Western contexts often require significant localization for effectiveness^[22].
- **Data privacy and ethics:** Collection of sensitive behavioural data raises privacy concerns, compounded by the absence of clear regulatory frameworks.^[27, 28]

Findings from broader educational AI studies reinforce these barriers, citing infrastructure constraints, digital literacy gaps, high implementation costs, and lack of strong data protection frameworks.^[29,30] Attitudinal constraints and stigma further complicate adoption among families and communities.^[31,32] Addressing these barriers requires coordinated efforts among policymakers, clinicians, AI developers, and community stakeholders.

3.4 Facilitators and Enablers

Several facilitators enable successful implementation of AI-augmented SST in India:

- **Multidisciplinary collaboration:** Engagement of paediatricians, psychologists, educators, AI developers, and families fosters holistic program development.^[33]
- **Localized training programs:** Structured training initiatives enhance therapist confidence and adoption of AI tools.^[7,23]
- **Community awareness initiatives:** Public campaigns help reduce stigma and increase acceptance of AI-based interventions^[24].
- **Policy support:** Government-led digital health and disability inclusion initiatives provide enabling frameworks for integration^[34].
- **User-centered design:** Involving adolescents with ASD and their families in tool development ensures cultural relevance and usability.^[35,36]

Additional enablers include parent-mediated interventions in resource-poor settings, developmental interventions in resource-rich contexts, and culturally adapted web-based curricula^[8,9]. Broader educational studies highlight mobile-first approaches, public-private partnerships, subsidized AI access, and teacher training programs as critical enablers^[29,30].

4. Discussion

Traditional approaches such as social stories, role-play, peer modelling, and video modelling demonstrate positive outcomes when culturally adapted^[4,6,7]. Integration into mainstream educational and community programs remains limited^[8,9].

AI-augmented SST tools offer a potential solution to therapist shortages and the need for individualized learning^[37]

Evidence from Indian pilot studies confirms that AI tools such as emotion recognition software, VR simulations, AI-generated social stories, and mobile apps are feasible and acceptable in urban adolescents with ASD.^{7, [11-13, 15-21, 38]} These platforms provide scalable, flexible environments for social practice and immediate feedback. Complementary findings from electronic assessments and web-based curricula also emphasize culturally responsive design.^[4,39]

Barriers include stigma, limited awareness, infrastructure limitations, digital literacy gaps, high costs, and lack of robust monitoring mechanisms.^[24,25,29,30,36] Facilitators include parent-mediated interventions, developmental interventions, multidisciplinary collaboration, localized training, community awareness, and policy support.^[7, 23, 33,34] AI is a complement, not a replacement, for human therapists or caregivers^[14, 35]. Robust data on clinical effectiveness, long-term impact, and cost-effectiveness remain sparse.^[40-43]

Implications for Practice:

- **Clinical practice:** AI tools as complements to human-led interventions.

- Education: Teacher training and curriculum adaptation.
- Technology design: Vernacular integration, cultural tailoring, and ethical safeguards.

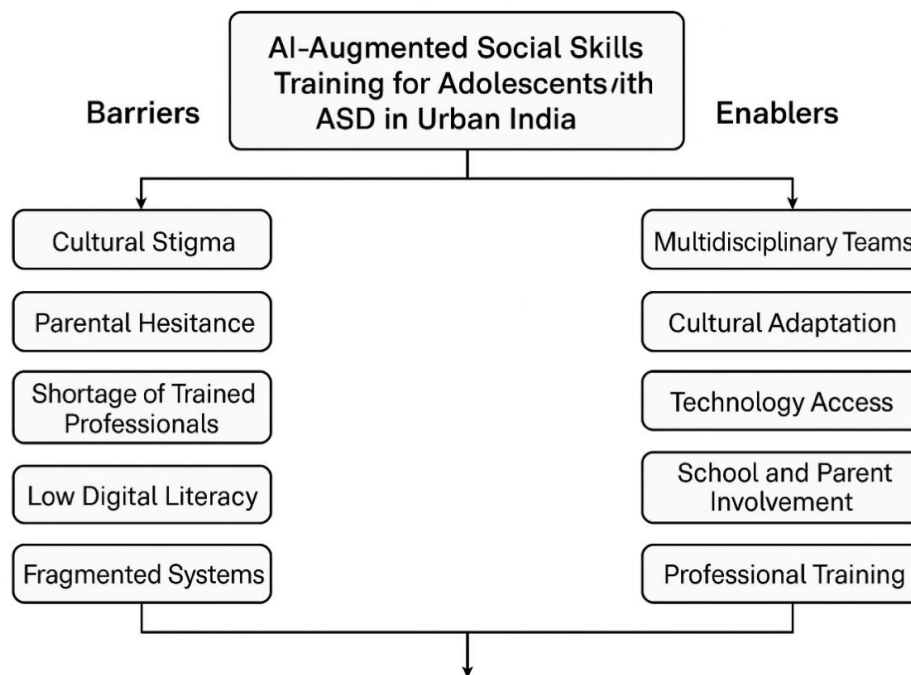
Implications for Policy:

- Infrastructure investment for digital literacy and access.
- Clear regulations on privacy, algorithmic bias, and ethical use.

- Inclusion frameworks integrating AI-SST tools.

Future Research Directions:

- Longitudinal studies across diverse Indian contexts.
- Comparative analyses of parent-mediated vs AI-augmented interventions.
- Culturally specific adaptations (multilingual and regional).
- Evaluation of ethical and privacy frameworks.



5. Conclusion

AI-augmented SST holds promise for supporting adolescents with ASD in urban India by enhancing personalization and accessibility (Figure.1). Realizing benefits requires culturally tailored tools, robust infrastructure, privacy safeguards, and professional therapist/family involvement. Collaborative efforts among healthcare providers, AI developers, educators, and families can harness AI's potential to improve social skills and quality of life.

Conflict of Interest : None

Summary of the review

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