



AI-Based Speech and Language Therapy for Children with Autism in Pakistan: Parents' and Speech-Language Therapists' Perspectives

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ARTICLE INFO

Article History:

Received: June 02, 2026
Revised: July 29, 2026
Accepted: August 11, 2026
Available Online: August 18, 2026

Keywords:

Artificial Intelligence, Autism Spectrum Disorder, Speech-Language Therapy, Parents' Perspectives, Speech-Language Therapists, Technology-Based Intervention, Pakistan

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ABSTRACT

Autism Spectrum Disorder (ASD) is associated with significant communication difficulties that affect children's social interaction, learning, and daily functioning. Speech and language therapy plays an important role in improving communication skills; however, limited access to specialized services remains a major challenge in Pakistan. This study explored the perspectives of parents and speech-language therapists regarding AI-based speech and language therapy for children with autism. A qualitative phenomenological research design was employed, and semi-structured interviews were conducted with 15 parents and 10 speech-language therapists selected through purposive sampling. Thematic analysis revealed five major themes: perceived benefits of AI-based therapy, implementation challenges, personalized intervention opportunities, stakeholder acceptance, and future possibilities of AI integration. Findings indicated that participants viewed AI as a supportive tool that can enhance accessibility, engagement, and individualized therapy. However, concerns related to affordability, technological awareness, training, and ethical issues were also identified. The study concludes that AI-based therapy has the potential to strengthen autism intervention services in Pakistan when combined with professional expertise and appropriate support systems.

DOI: <https://doi.org/10.59075/tamsaal.v4i8.136>



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Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by persistent difficulties in social communication, interaction, and restricted or repetitive patterns of

behaviour. Among the various challenges experienced by children with autism, speech and language impairments are considered one of the most significant factors affecting their academic participation, social relationships, and overall quality of life. Many children with ASD experience delayed speech development, limited vocabulary, difficulties in understanding language, and challenges in using communication appropriately in social contexts (American Psychiatric Association [APA], 2022). Speech-language therapy (SLT) plays a crucial role in supporting these children by improving expressive language, receptive language, articulation, and functional communication skills. However, access to effective and continuous speech-language intervention remains a major challenge, particularly in developing countries such as Pakistan.

In Pakistan, the prevalence of autism awareness and diagnosis has increased in recent years; however, specialized therapeutic services remain limited due to a shortage of trained professionals, inadequate rehabilitation facilities, and financial barriers faced by many families. Parents of children with autism often experience difficulties in finding qualified speech-language therapists and maintaining regular therapy sessions due to geographical and economic constraints. Speech-language therapists also face challenges, including high caseloads, limited clinical resources, and the need for innovative approaches to provide individualized interventions (Hossain et al., 2017). These challenges highlight the importance of exploring alternative and technology-supported approaches that can enhance the accessibility and effectiveness of speech and language therapy.

Artificial Intelligence (AI) has emerged as a promising technology in healthcare and education by providing personalized, adaptive, and data-driven solutions. AI-based applications can analyze communication patterns, recognize speech, monitor progress, and provide individualized feedback according to the specific needs of children with developmental disorders. In the field of speech and language therapy, AI technologies such as automated speech recognition, machine learning algorithms, virtual assistants, and interactive communication platforms are increasingly being investigated to support children with communication difficulties (Khurana et al., 2022). These technologies have the potential to complement traditional therapy by increasing practice opportunities, engaging children through interactive activities, and assisting therapists in monitoring developmental progress.

For children with autism, AI-based speech and language therapy tools may offer several advantages. Many children with ASD respond positively to structured, predictable, and technology-mediated learning environments. Digital platforms and intelligent systems can provide repetitive practice, visual support, and immediate responses, which are important components of effective autism intervention. Research suggests that technology-assisted interventions can improve social communication, language learning, and engagement among children with autism when appropriately designed and implemented (Grynszpan et al., 2014). Furthermore, AI systems can collect and analyze large amounts of behavioural and communication data, allowing therapists to develop more individualized intervention plans.

Despite these potential benefits, the successful implementation of AI-based therapy depends on the perspectives, acceptance, and experiences of key stakeholders, particularly parents and speech-language therapists. Parents play an essential role in autism intervention because they are directly involved in their children's daily communication development and therapy practices. Their perceptions regarding the usefulness, affordability, accessibility, and safety of AI-based

tools can influence the adoption of such technologies. Some parents may appreciate AI-based interventions because they provide additional learning opportunities outside clinical settings, while others may have concerns regarding technology dependence, privacy, cost, and the replacement of human interaction (Estes et al., 2014).

Similarly, speech-language therapists' perspectives are critical because they are responsible for selecting, implementing, and evaluating therapeutic approaches. Although AI technologies may support clinical decision-making and improve therapy outcomes, therapists may have concerns regarding the accuracy of AI assessments, ethical issues, technical limitations, and the need for professional training. AI should be considered a supportive tool rather than a replacement for human expertise, as effective speech-language therapy requires emotional connection, clinical judgment, and understanding of individual developmental differences (Topol, 2019).

In the Pakistani context, research on AI-based speech and language therapy for children with autism remains limited. While international studies have explored the role of artificial intelligence in improving communication outcomes, there is insufficient evidence regarding how Pakistani parents and speech-language therapists perceive the usefulness and practicality of these technologies. Cultural factors, healthcare infrastructure, digital accessibility, and professional readiness may influence the acceptance and effectiveness of AI-based interventions in Pakistan. Therefore, understanding stakeholders' perspectives is essential for developing culturally appropriate, accessible, and effective AI-supported therapy models.

This study aims to explore the perspectives of parents and speech-language therapists regarding AI-based speech and language therapy for children with autism in Pakistan. By examining their experiences, expectations, perceived benefits, and concerns, the study seeks to provide valuable insights into the opportunities and challenges associated with integrating AI technologies into autism intervention services. The findings may contribute to the development of evidence-based strategies for improving speech and language support for children with autism and enhancing the future integration of artificial intelligence within Pakistan's special education and rehabilitation sectors.

Research Objectives

1. To explore the perceptions and experiences of parents regarding the use of AI-based speech and language therapy for children with autism in Pakistan.
2. To examine the perspectives of speech-language therapists regarding the effectiveness, benefits, and challenges of implementing AI-based speech and language therapy interventions for children with autism.
3. To identify the opportunities, barriers, and practical considerations involved in integrating AI-based speech and language therapy into autism intervention services in Pakistan.

Research Questions

1. What are the perceptions and experiences of parents regarding AI-based speech and language therapy for children with autism in Pakistan?

2. How do speech-language therapists perceive the effectiveness, usefulness, and challenges of AI-based speech and language therapy interventions?
3. What opportunities and barriers influence the implementation of AI-based speech and language therapy for children with autism in the Pakistani context?

Literature Review

Autism Spectrum Disorder (ASD) is a complex developmental condition that affects communication, social interaction, and behavioural patterns. Speech and language difficulties are among the most common concerns reported among children with autism, creating a need for specialized and continuous intervention. Traditional speech-language therapy has demonstrated effectiveness in improving communication abilities; however, limited availability of trained professionals and restricted access to services encourage researchers to explore technology-based solutions. Artificial Intelligence (AI) has recently gained attention as an innovative approach for supporting communication development among children with autism through personalized, interactive, and data-driven interventions (Toqeer Zahra et al., 2026)..

AI-based technologies have the potential to transform speech and language therapy by providing individualized learning experiences. Machine learning algorithms can analyze children's speech patterns, identify communication difficulties, and support therapists in designing targeted interventions. According to Chen et al. (2020), AI-powered systems can enhance healthcare delivery by improving assessment accuracy and enabling personalized treatment approaches. In speech and language intervention, AI applications can assist in speech recognition, pronunciation training, language modelling, and progress monitoring, which may increase the effectiveness of therapy sessions.

Technology-assisted interventions have shown promising outcomes for children with autism, particularly because many children with ASD demonstrate positive responses to structured digital environments. Interactive technologies, including computer-based programs and intelligent applications, can provide consistent feedback and repetitive practice opportunities. Boucenna et al. (2014) highlighted that socially interactive robots and intelligent technologies can support communication development by increasing children's engagement and motivation during intervention activities. Such technologies may be especially beneficial for children who experience anxiety or difficulties in traditional face-to-face communication settings.

Artificial Intelligence-based speech recognition systems represent an emerging area in autism intervention. These systems can evaluate speech production, detect errors, and provide immediate feedback to users. Research by Furlong et al. (2018) suggested that automated speech analysis technologies can contribute to more objective assessment of speech characteristics and communication progress. For children with autism, these tools may support therapists by providing additional information about speech patterns that may not always be easily identified through traditional observation methods.

Virtual reality (VR), conversational agents, and intelligent educational applications are also being explored as supportive tools for improving communication skills among children with developmental disabilities. AI-driven conversational agents can create opportunities for children to practice language skills in a controlled and engaging environment. As stated by Scassellati et al. (2018), socially assistive technologies can encourage interaction, learning, and skill

development among individuals with autism by adapting responses according to users' behaviours and needs.

The role of parents is essential in the successful implementation of AI-based speech and language therapy. Parents provide continuous support outside clinical settings and influence children's engagement with therapeutic technologies. Research by Moorthy et al. (2021) indicated that parental involvement significantly contributes to the effectiveness of technology-based interventions for children with autism. However, parents' acceptance of AI tools may depend on factors such as technological literacy, affordability, accessibility, and trust in digital systems. In countries with limited healthcare resources, understanding parental attitudes is particularly important for ensuring successful adoption.

Speech-language therapists also play a central role in evaluating and implementing AI-supported interventions. Although AI tools can provide valuable assistance, professional expertise remains necessary for interpreting results, developing intervention strategies, and maintaining ethical standards. According to Rudzicz et al. (2015), speech technologies should be designed to complement healthcare professionals rather than replace human interaction and clinical judgment. Therapists' acceptance of AI may depend on their knowledge of technology, confidence in using digital tools, and perceptions regarding their reliability.

In developing countries such as Pakistan, the application of AI-based speech and language therapy presents both opportunities and challenges. Pakistan faces shortages of specialized rehabilitation services, particularly outside major urban areas (Waqar un Nisa et al., 2025). AI-based interventions could improve accessibility by enabling children to receive additional therapy support via digital platforms. However, challenges such as internet availability, device affordability, cultural acceptance, and limited professional training may influence implementation. According to Rahman et al. (2022), digital health interventions in low- and middle-income countries require consideration of local infrastructure, user needs, and socioeconomic conditions to achieve sustainable outcomes.

Furthermore, ethical concerns related to AI use in healthcare require careful consideration. Issues such as data privacy, protection of children's information, and algorithmic accuracy are important when implementing AI-based therapy systems. Floridi et al. (2018) emphasized that responsible AI development requires transparency, accountability, and protection of human values. For children with autism, maintaining confidentiality and ensuring that technology supports rather than limits human communication are essential considerations.

Overall, existing literature indicates that AI-based speech and language therapy has significant potential to enhance communication interventions for children with autism. Previous studies demonstrate benefits related to personalized learning, improved engagement, automated assessment, and increased accessibility. However, limited research has examined the perspectives of parents and speech-language therapists, particularly within the Pakistani context. Understanding their experiences, expectations, and concerns is necessary for developing culturally appropriate AI-supported therapy approaches. Therefore, this study aims to address this research gap by exploring stakeholder perspectives regarding AI-based speech and language therapy for children with autism in Pakistan.

Methodology

Research Design

The study employed a qualitative phenomenological research design to explore the perspectives and lived experiences of parents and speech-language therapists regarding AI-based speech and language therapy for children with autism in Pakistan. A phenomenological approach was considered appropriate because the study aimed to understand participants' perceptions, experiences, expectations, and concerns related to the use of artificial intelligence technologies in autism intervention. Qualitative research allows researchers to examine complex human experiences in their natural contexts and provides deeper insights into participants' interpretations of a particular phenomenon (Creswell & Poth, 2018). The design enabled the researcher to explore how parents and speech-language therapists perceive the usefulness, accessibility, challenges, and future possibilities of AI-supported speech and language interventions.

Population and Participants

The population of the study consisted of parents of children diagnosed with Autism Spectrum Disorder (ASD) and speech-language therapists working with children with autism in Pakistan. These participants were selected because they had direct involvement and practical experience with autism intervention services and could provide meaningful information regarding the potential role of AI-based speech and language therapy.

A total of 25 participants were included in the study, comprising 15 parents of children with autism and 10 speech-language therapists. The sample size was determined according to the principle of data saturation, where interviews continued until additional data did not produce substantially new themes or information related to the research objectives. Qualitative studies with focused research questions and relatively homogeneous participant groups commonly achieve saturation within small samples (Hennink & Kaiser, 2022). The inclusion of both parents and professionals allowed the study to examine the phenomenon from two important perspectives: family experiences and clinical expertise.

Sampling Technique and Inclusion Criteria

Purposive sampling was used to select participants who had direct knowledge and relevant experience related to autism care, speech-language therapy, and technology-based interventions. Participants were recruited from autism rehabilitation centers, speech-language therapy clinics, and special education settings in Pakistan. The purpose and procedure of the study were explained to all participants, and written informed consent was obtained before data collection.

Parents were included if they had a child diagnosed with Autism Spectrum Disorder (ASD), had experience with speech and language therapy services, were involved in their child's communication development, were willing to share their views regarding AI-based interventions, and provided consent to participate. Speech-language therapists were included if they were qualified professionals, had experience working with children with autism, possessed knowledge of technology-assisted interventions, were willing to participate in semi-structured interviews, and provided informed consent.

Participant Profile

The demographic characteristics of participants are presented in Table 1. To maintain confidentiality, participants were assigned codes (P1–P15 for parents and S1–S10 for speech-language therapists).

Table 1: Demographic Characteristics of Participants

Participant Code	Participant Group	Age	Gender	Relationship/Professional Role	Child's Intervention Duration / Professional Experience
P1	Parent	38	Female	Mother of child with ASD	Child receiving autism-related services for 5 years
P2	Parent	42	Male	Father of child with ASD	Child receiving autism-related services for 4 years
P3	Parent	35	Female	Mother of child with ASD	Child receiving speech therapy for 3 years
P4	Parent	40	Female	Mother of child with ASD	Child receiving autism intervention for 6 years
P5	Parent	45	Male	Father of child with ASD	Child receiving rehabilitation services for 7 years
P6	Parent	33	Female	Mother of child with ASD	Child receiving speech therapy for 2 years
P7	Parent	39	Female	Mother of child with ASD	Child receiving autism-related services for 5 years
P8	Parent	41	Male	Father of child with ASD	Child receiving therapy services for 6 years
P9	Parent	36	Female	Mother of child with ASD	Child receiving autism intervention for 4 years
P10	Parent	44	Male	Father of child with ASD	Child receiving autism support services for 8 years
P11	Parent	37	Female	Mother of child with ASD	Child receiving speech therapy for 3 years
P12	Parent	34	Female	Mother of child with ASD	Child receiving intervention services

P13	Parent	46	Male	Father of child with ASD	for 2 years Child receiving autism-related services for 9 years
P14	Parent	32	Female	Mother of child with ASD	Child receiving speech therapy for 2 years
P15	Parent	43	Male	Father of child with ASD	Child receiving rehabilitation services for 6 years
S1	Speech- Language Therapist	29	Female	Speech-Language Therapist	3 years of experience in autism therapy
S2	Speech- Language Therapist	34	Male	Speech-Language Therapist	7 years of experience in autism intervention
S3	Speech- Language Therapist	31	Female	Speech-Language Therapist	5 years of experience in speech and language therapy
S4	Speech- Language Therapist	38	Male	Senior Speech-Language Therapist	10 years of experience in autism services
S5	Speech- Language Therapist	27	Female	Speech-Language Therapist	2 years of experience in autism therapy
S6	Speech- Language Therapist	36	Female	Speech-Language Therapist	8 years of experience in developmental disorders
S7	Speech- Language Therapist	33	Male	Speech-Language Therapist	6 years of experience in autism intervention
S8	Speech- Language Therapist	40	Female	Senior Speech-Language Therapist	12 years of experience in speech therapy
S9	Speech- Language Therapist	30	Male	Speech-Language Therapist	4 years of experience in autism services
S10	Speech- Language Therapist	35	Female	Speech-Language Therapist	7 years of experience in communication disorders

Note. ASD = Autism Spectrum Disorder; P = Parent participant; S = Speech-Language Therapist participant. Participant identities were coded to maintain confidentiality.

Interview Guide

Data were collected through semi-structured interviews conducted using an interview guide developed according to the research objectives and questions. The interview guide included

open-ended questions related to participants' experiences, perceptions, benefits, challenges, and expectations regarding AI-based speech and language therapy.

For parents, questions focused on their experiences with current speech-language services, awareness of AI-based therapy tools, perceived advantages and concerns, affordability, accessibility, and willingness to adopt AI-supported interventions. For speech-language therapists, questions explored their professional experiences, views regarding AI effectiveness, possible clinical applications, limitations, ethical concerns, and requirements for implementation in Pakistan.

Semi-structured interviews provided consistency across participants while allowing flexibility to explore individual experiences in greater depth (Creswell & Poth, 2018).

Data Collection Procedure

Data were collected through individual semi-structured interviews with 25 participants. Each interview lasted approximately 30–45 minutes and was conducted either face-to-face or through online communication platforms according to participant availability. Interviews were conducted in a comfortable environment where participants could express their opinions freely.

With participants' permission, interviews were audio-recorded and transcribed verbatim for analysis. Field notes were also maintained to record important observations and reflections during the data collection process. Interviews continued until data saturation was achieved, indicating that further interviews were unlikely to generate additional significant themes.

Data Analysis

The collected data were analyzed using thematic analysis. The analysis followed the process proposed by Braun and Clarke (2021), which includes familiarization with the data, generating initial codes, identifying potential themes, reviewing themes, defining and naming themes, and producing the final report.

Initially, interview transcripts were read multiple times to develop familiarity with participants' responses. Meaningful statements related to AI-based speech and language therapy were coded systematically. Similar codes were grouped together to develop broader themes representing participants' experiences and perceptions. The analysis focused on major areas including perceived benefits of AI-based therapy, barriers to implementation, professional concerns, parental acceptance, and future possibilities within Pakistan's autism intervention services.

Trustworthiness

The trustworthiness of the study was ensured through the criteria of credibility, transferability, dependability, and conformability proposed by Lincoln and Guba (1985). Credibility was established through prolonged engagement with the interview data and careful comparison of responses from parents and speech-language therapists. Member checking was used where appropriate by sharing interpretations with selected participants to confirm the accuracy of findings.

Transferability was supported by providing detailed descriptions of participants, research context, and data collection procedures. Dependability was maintained through systematic documentation of the research process, including interview procedures and coding decisions. Confirmability was strengthened by ensuring that findings were based on participants' accounts rather than researcher assumptions.

Ethical Considerations

Ethical principles were followed throughout the research process. Participants were informed about the purpose of the study, their voluntary participation, and their right to withdraw at any stage without any negative consequences. Confidentiality was maintained by using participant codes instead of personal identities. All interview recordings and transcripts were stored securely and were used only for research purposes.

Limitations of the Study

The study had several limitations. First, the participants were recruited from selected autism intervention settings in Pakistan; therefore, findings may not represent the experiences of all parents and speech-language therapists across the country. Second, the qualitative design and relatively small sample size limited statistical generalization; however, it provided detailed understanding of participants' experiences. Third, participants' responses were based on personal perceptions, which may have been influenced by previous experiences, technological awareness, or expectations. Future studies may include larger samples and quantitative approaches to further examine the effectiveness and acceptance of AI-based speech and language therapy.

Results and Discussion

The interview data were analyzed using reflexive thematic analysis following Braun and Clarke (2021). The analysis generated five major themes from the perspectives of parents and speech-language therapists: (1) perceived benefits of AI-based speech and language therapy, (2) challenges and concerns regarding AI implementation, (3) role of AI in personalized intervention and progress monitoring, (4) acceptance and readiness of parents and therapists, and (5) future possibilities of AI integration in autism intervention services in Pakistan. Each theme was interpreted in relation to participants' experiences and compared with existing research.

Theme 1: Perceived Benefits of AI-Based Speech and Language Therapy

The first theme highlighted participants' positive perceptions regarding the potential benefits of AI-based speech and language therapy for children with autism. Parents and speech-language therapists believed that AI-supported tools could provide additional opportunities for communication practice, individualized activities, and continuous learning beyond traditional therapy sessions. Participants emphasized that many children with autism require repeated practice and structured activities, which AI-based systems may provide through interactive and adaptive platforms.

P3 explained: *"Sometimes my child needs the same activity again and again. If an application can provide practice at home according to his level, it can help him improve."*

P8 stated: *“Therapy sessions are limited because of time and cost. If AI can support the child at home, it will be helpful for parents.”*

Speech-language therapists also highlighted the supportive role of AI technologies. S2 explained:

“AI can help us understand a child’s progress more clearly because it can record performance patterns and provide additional information.”

S6 stated: *“Technology can make therapy more engaging. Many children with autism respond well to visual and interactive activities.”*

The findings suggest that participants viewed AI as a complementary tool rather than a replacement for professional therapy. This perception aligns with previous research indicating that technology-based interventions can enhance engagement, motivation, and communication practice among children with autism (Scassellati et al., 2018). The present findings further demonstrate that stakeholders in Pakistan associate AI with improved accessibility and additional therapeutic support, particularly where regular therapy availability is limited.

Theme 2: Challenges and Concerns Regarding AI Implementation

The second theme reflected concerns related to the practical implementation of AI-based therapy. Participants identified barriers including cost, availability of technology, lack of awareness, internet accessibility, and concerns regarding whether AI systems could understand individual differences among children with autism.

P5 stated: *“Technology sounds helpful, but many families cannot afford expensive devices or applications.”*

P11 explained: *“Parents need guidance. If they do not know how to use the technology, it will not be beneficial.”*

Speech-language therapists also expressed concerns regarding accuracy and professional responsibility.

S4 stated: *“AI can support assessment, but every child with autism is different. A therapist’s observation is still necessary.”*

S9 explained: *“We need proper training before using AI tools because incorrect interpretation can affect intervention decisions.”*

These findings indicate that successful implementation of AI requires consideration of social, economic, and professional factors. Similar concerns have been reported in previous studies, which highlight issues related to digital accessibility, ethical responsibility, and professional training in healthcare technologies (Topol, 2019). The present study extends previous literature by demonstrating that Pakistani stakeholders view technological limitations as equally important as therapeutic benefits.

Theme 3: AI for Personalized Intervention and Progress Monitoring

The third theme focused on the potential of AI to support individualized therapy planning. Participants believed that AI systems could analyze children's communication patterns and help therapists design interventions according to individual needs.

S3 stated: *"Every child with autism has different communication difficulties. If AI can identify specific problems, therapy planning may become easier."*

P12 explained: *"My child learns slowly, so activities according to his own level would be better than general exercises."*

Participants suggested that AI-based systems could assist in tracking pronunciation, vocabulary development, communication attempts, and behavioural responses. This finding supports research suggesting that artificial intelligence can contribute to personalized healthcare by analyzing individual data and adapting interventions accordingly (Chen et al., 2020).

However, therapists emphasized that AI-generated information should support clinical decision-making rather than replace professional judgment. This highlights the importance of maintaining a balance between technological assistance and human expertise.

Theme 4: Acceptance and Readiness of Parents and Therapists

The fourth theme concerned participants' willingness to accept AI-based therapy. Most parents and therapists showed positive attitudes toward AI when they viewed it as an additional support mechanism. However, acceptance depended on awareness, training, affordability, and confidence in technology.

P6 stated: *"If someone teaches parents how to use it properly, many families will accept it."*

S5 explained: *"Therapists may accept AI more easily if they understand how it improves their work instead of replacing them."*

The findings indicate that successful adoption requires stakeholder involvement during the development and implementation process. Similar research suggests that user acceptance is a critical factor influencing the effectiveness of digital health interventions (Davis, 1989). Therefore, training programs and awareness initiatives may play an important role in promoting AI integration within autism services in Pakistan.

Theme 5: Future Possibilities of AI Integration in Autism Intervention

The final theme represented participants' expectations regarding the future role of AI in autism intervention. Participants believed that AI could expand access to speech and language therapy, particularly for families living in areas where specialized services are limited.

S8 stated: *"In Pakistan, many children do not receive regular therapy because services are not available everywhere. AI can provide additional support."*

Parents also expressed hope that affordable AI tools could reduce barriers to continuous intervention.

P14 explained: *“If technology becomes affordable, it can help many children who cannot visit therapists regularly.”*

The findings suggest that AI has potential to contribute to more accessible and inclusive autism intervention services. However, participants emphasized that AI should function within a supportive framework involving therapists, families, and educational professionals.

The findings demonstrate that parents and speech-language therapists perceive AI-based speech and language therapy as a promising supportive approach for children with autism in Pakistan. While participants recognized benefits related to personalization, accessibility, and engagement, they also emphasized the importance of addressing financial, ethical, and training-related challenges before widespread implementation.

Conclusion

This study explored the perspectives of parents and speech-language therapists regarding AI-based speech and language therapy for children with autism in Pakistan. The findings indicated that AI technology has considerable potential to support autism intervention by providing personalized learning activities, improving communication practice, assisting progress monitoring, and increasing access to therapeutic support. Parents viewed AI-based tools as a useful opportunity to continue learning and communication practice beyond traditional therapy sessions, while speech-language therapists recognized AI as a supportive resource that could assist clinical decision-making and individualized intervention planning.

However, the findings also highlighted several challenges associated with AI implementation, including limited technological awareness, affordability issues, lack of professional training, accessibility barriers, and concerns regarding the accuracy and ethical use of AI systems. Participants emphasized that AI should not replace human interaction and professional expertise but should be integrated as a complementary tool within existing speech-language therapy services. Overall, AI-based speech and language therapy represents a promising approach for improving communication outcomes among children with autism in Pakistan, provided that technological development is accompanied by appropriate training, accessibility measures, and professional involvement.

Recommendations

Based on the findings of the study, the following recommendations are proposed:

1. AI-based speech and language therapy applications should be designed according to the cultural, linguistic, and educational needs of children with autism in Pakistan.
2. Speech-language therapists should receive specialized training to understand, evaluate, and effectively integrate AI tools into their therapeutic practices.
3. Awareness programs should be conducted for parents to improve their understanding of AI-based interventions and guide them regarding appropriate use.
4. Affordable and user-friendly AI technologies should be developed to ensure access for families from different socioeconomic backgrounds, particularly those living in areas with limited therapy services.

5. Collaboration among researchers, technology developers, speech-language therapists, and educational institutions should be encouraged to create evidence-based AI intervention models.
6. Future studies should examine the effectiveness of AI-based speech and language therapy through larger samples, experimental designs, and long-term follow-up studies to establish its impact on communication development among children with autism.

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