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Technopreneurial Language Development Strategies for Children with ADHD

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ABSTRACT

This study explores the characteristics of speech disorders in children with ADHD and examines effective intervention strategies, including technopreneurial solutions, and parental language practices to support their communication development. The **research aims** to bridge the **gap** in current intervention models by integrating traditional speech therapy with innovative, technology-driven approaches, such as AI-powered diagnostic tools and digital platforms. Using a qualitative case study **method**, data were collected through structured clinical observations, speech sample analysis, and in-depth interviews with pediatricians, child psychologists, speech therapists, and parents of children with varying types of ADHD. The **results** reveal that children with ADHD commonly experience articulation difficulties, disfluency, and impairments in receptive, expressive, and pragmatic language skills. A **novelty** of this study is the development of a structured intervention model that combines conventional speech therapy with ADHD-sensitive techniques, including behaviour management, visual aids, and environmental adaptations, alongside AI-driven diagnostic tools and digital platforms to enhance accessibility and engagement. Additionally, a practical guide to language parenting was designed to empower parents and caregivers to actively support therapy outcomes by using consistent communication strategies at home. The study also produced a comprehensive database of speech characteristics in Indonesian children with ADHD, serving as a foundation for further research and development of more effective assessment instruments. This research underscores the importance of multidisciplinary collaboration and parental involvement in addressing speech disorders in children with ADHD, aligning with SDGs 3 (Good Health and Well-being) and SDGs 4 (Quality Education).

1. INTRODUCTION

Language development in early childhood is a critical marker of cognitive, social, and emotional growth. However, for children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD), language development often encounters significant barriers. Speech disorders, affecting around 9% of children aged 2-17 years, are common developmental disorders that cause difficulty in pronouncing certain sounds and con-

structing coherent speech [1]. Epidemiological studies show that speech disorders in school aged children range from 5-10% [2]. ADHD, a neurodevelopmental disorder, impairs attention span, impulse control, and hyperactivity, all of which can hinder speech and communication skills. Children with ADHD often experience delays in expressive and receptive language, poor articulation, and difficulty understanding verbal instructions [3, 4]. As noted by research, "children with ADHD often have problems not only in language development but also in following through with the tasks of communication," making it more challenging for them to integrate into social environments. Globally, ADHD affects 5-7% of the school-aged child population [5, 6]. When left unaddressed, speech disorders in children with ADHD can significantly hinder academic progress and social integration [7].

Given these challenges, there is an urgent need for intervention strategies that go beyond conventional clinical approaches [8]. Leveraging digital technology to support therapy and increase parental involvement could improve outcomes [9–11]. Despite the availability of digital tools like speech therapy apps, interactive games, and online parenting modules, their potential remains underutilized in managing speech disorders for children with ADHD [12]. Traditional speech therapy often faces constraints such as high cost, limited accessibility, and low parental engagement. Furthermore, existing interventions rarely incorporate innovative, technology-driven solutions that integrate technopreneurial strategies technology based entrepreneurial innovations with language parenting techniques and AI powered early diagnosis tools [13, 14].

One critical gap is the limited use of technopreneurial strategies to scale and make speech therapy more accessible, especially in underserved regions [15]. Many parents lack the necessary tools and knowledge to detect early symptoms of speech disorders or access engaging, affordable therapeutic services. This highlights the need for integrated, adaptive intervention strategies that emphasize collaboration between parents, therapists, and technology developers. To address these issues, it is essential to explore how technopreneurial strategies such as AI-driven diagnostic tools, home accessible speech therapy apps, and digital parenting platforms—can be effectively applied to support speech therapy for children with ADHD.

ADHD often affects preschool and primary school-age children, a critical period for learning and socialization, making early intervention vital for their survival and development [16, 17]. It is estimated that 30-50% of children with ADHD experience speech disorders, which impact various aspects of communication, such as limited vocabulary, articulation issues, and difficulties with receptive and expressive language processing [18]. However, the speech therapy approaches currently in use are often generic and not tailored to the specific cognitive and behavioural characteristics of children with ADHD. Approximately 76% of speech therapists in five major cities in Indonesia rely on standard intervention protocols, which do not adequately address ADHD-related challenges, such as attention regulation, response inhibition, and working memory [19, 20]. This underscores the need for interventions that are more responsive to the unique needs of children with ADHD [21].

Research also aligns with Sustainable Development Goal 3 (Good Health and Well-being), research aims to ensure healthy lives and promote well-being for all at all ages, particularly by addressing the health challenges of children with ADHD and speech disorders [22, 23]. By developing scalable, accessible, and effective interventions, this study aims to enhance the quality of care and therapeutic outcomes for children with ADHD [24]. Furthermore, the study contributes to SDGs 4 (Quality Education) by promoting inclusive education through the integration of digital technologies and family centered approaches to support children's language development, both in school and at home [25]. Access to better diagnostic tools, personalized learning strategies, and adaptive therapies can help create more equitable educational opportunities for children with ADHD, particularly in underprivileged communities [26].

To explore these challenges, the study is guided by two primary questions:

- How can technopreneurial strategies be effectively applied to address speech disorders in children with ADHD?
- How can language parenting and diagnostic technologies support the success of such interventions?

These questions are increasingly relevant as digital tools, like speech therapy apps and interactive platforms, are becoming more widely available, yet they are still underused. Research indicates that when parents actively engage using guided tools, language outcomes for children improve significantly [27]. Parental involvement not only shortens the duration of therapy but also enhances its overall effectiveness, highlighting the importance of language parenting in speech development [28, 29].

As a result, a multidisciplinary approach that integrates speech therapy, education, parental training, and digital innovation is crucial for developing scalable, effective, and inclusive intervention models [30]. This study adopts a qualitative methodology, using a systematic literature review to analyze scholarly articles, case studies, and reports on ADHD, speech therapy, and tech based interventions. The review aims to identify technopreneurial innovations in this field, evaluate language parenting practices, and examine emerging AI-powered diagnostic tools. AI-based diagnostic systems can offer early, accurate insights into children's language difficulties, enabling timely intervention [31–33]. The primary objective of this study is to formulate an integrative intervention framework that combines technology, family based strategies, and early diagnosis to provide continuous, personalized support for children with ADHD and speech disorders [34].

Initial findings suggest that technopreneurial strategies, such as home accessible speech therapy apps, digital parenting platforms, and AI-driven screening tools, have strong potential to complement and enhance traditional speech therapy models. These innovations not only improve therapy effectiveness but also empower parents and educators to actively support children's speech development. Interactive technology, which creates immersive learning experiences, can be particularly beneficial for children with ADHD, who respond well to dynamic and engaging stimuli [35, 36]. Additionally, the scalability of such technologies offers opportunities for broader implementation, particularly in underserved areas, helping bridge the gap in access to high-quality therapeutic services [37, 38]. Ultimately, this research aims to contribute both theoretically and practically to the design of effective educational and therapeutic interventions, offering hope for a more inclusive future where children with ADHD can develop their communication skills in supportive, techenhanced environments [39, 40].

2. METHODOLOGY

2.1. Research Design

This study adopts a qualitative research approach using a case study design to investigate the phenomenon of speech disorders in children with ADHD, the appropriate intervention strategies, and the role of parental language parenting. The case study method allows for a deep understanding of the real life complexities of ADHD and speech disorde data collection and analysis techniques to developtic systems and digital speech therapy tools can be developed and scaled in real-world settings. The study involves children aged 3 to 7 years diagnosed with ADHD and experiencing speech disorders, along with their families. Data will be collected through method triangulation, including participatory clinical observation, in-depth interviews, and document analysis [41]. Naturalistic participatory observations will be conducted in settings such as the home, school, and therapy sessions to capture the child's communicative interactions. In-depth interviews will be held with key informants, including parents, speech therapists, psychologists, pediatricians, and teachers. Document analysis will include medical records, psychological assessments, therapy portfolios, and developmental notes. Additionally, speech samples will be recorded and linguistically analyzed to identify specific speech disorder patterns in children with ADHD. This research design enables a rich, contextualized understanding of causal factors, interactional dynamics, and the effectiveness of technopreneurial and parental interventions [42, 43].

To gather comprehensive data, the research will employ method triangulation, combining participatory clinical observation, in-depth interviews, and document analysis. Naturalistic participatory observations will take place in various settings, such as the home, school, and therapy sessions, to capture how children interact and communicate. In depth interviews will be conducted with key informants, including parents, speech therapists, psychologists, pediatricians, and teachers. Document analysis will focus on medical records, psychological assessments, therapy portfolios, and developmental notes to provide a holistic view of the children's speech and behavioural development [44].

Furthermore, speech samples will be recorded and analyzed linguistically to identify specific speech disorder patterns among children with ADHD. This research design is aimed at providing a rich, contextualized understanding of the underlying causes, interactional dynamics, and the effectiveness of both technopreneurial and parental interventions in addressing speech disorders. This approach offers valuable insights into how digital and entrepreneurial innovations can enhance therapeutic practices and support children with ADHD in real world [45].

2.2. Research Procedure

To explore effective intervention strategies for speech disorders in children with ADHD, the research will follow a structured approach. This approach ensures that the study's findings are comprehensive and can be

applied practically in real-world settings. The methodology focuses on integrating various data collection and analysis techniques, with the aim of developing both therapeutic models and practical tools for parents and professionals. The research will be conducted in five interrelated stages, the first stage, Instrument Development, involves designing structured interview protocols for parents, caregivers, and speech therapists. The expected outputs include assessment tools for speech disorders and validated interview protocols. These instruments will be reviewed and validated by at least three experts in linguistics, speech therapy, and child psychology.

Next, in the Data Collection phase, field studies will be carried out to gather data on the specific characteristics of speech disorders in children with ADHD, including data on their prevalence. Observations and interviews will be the primary methods used to collect this information. Following that, the Data Analysis and Intervention Model Development phase will involve analyzing qualitative data from observations and interviews. The goal is to identify the relationship between ADHD characteristics and speech disorder patterns. Based on this analysis, a targeted intervention model will be developed for speech therapists to use in their practice. In the Development of Language Parenting Model stage, a model will be created to guide parents, caregivers, and teachers in implementing strategies at home and school. This ensures a collaborative approach to managing speech disorders, integrating the efforts of both therapy professionals and family members.

Finally, the Compilation of Reference Guidelines phase will involve compiling comprehensive materials on intervention strategies and language parenting approaches. These references will serve as practical guides for speech therapists, parents, caregivers, and educators, ensuring that the intervention strategies are easily accessible and actionable.

2.3. Data Sources and Research Location

This study involves three pairs of parents of children with ADHD of different subtypes as primary data sources. These parents provide direct insights into language parenting practices, child behavior, activities, and the severity of speech disorders. Secondary data is collected indirectly from key informants such as pediatricians, medical rehabilitation doctors, child psychologists, and speech therapists. Additional data is drawn from documentation, behavioural photos, letters, archives, and relevant literature on parenting and child speech development. The research is conducted in the homes of children with ADHD, hospitals, and child development clinics chosen because these are the primary settings where speech therapy takes place.

2.4. Data Collection Technique

Several techniques are employed to collect data, to ensure the validity of the research data, the study involves three children with varying types of ADHD along with their respective parents. To guarantee the validity of the research findings, multiple data collection methods direct observation, in-depth interviews, and document analysis are employed. This triangulation of methods will provide comprehensive insights into the intersection of ADHD characteristics, speech disorders, and intervention strategies, ultimately contributing to the development of effective, tech-enhanced therapy solutions.

In addressing speech disorders in children with ADHD, the study aligns with SDGs 3 (Good Health and Well-being) by focusing on improving health outcomes for children with neurodevelopmental disorders. Early and effective interventions for speech disorders can significantly enhance the quality of life for children with ADHD, improving not only their communication skills but also their social interactions and emotional well-being. By providing multidisciplinary interventions combining speech therapy, behavioural management, and parental involvement the study supports a comprehensive approach to improving the health and development of children with ADHD.

Additionally, the integration of technology driven interventions such as AI-based diagnostic tools, digital speech therapy applications, and language parenting platforms aligns with SDGs 4 (Quality Education). These tools enhance accessibility and provide tailored learning experiences for children with ADHD, ensuring that they receive the necessary support to thrive academically and socially. By empowering both parents and educators with the right tools, the study emphasizes the importance of inclusive education practices, especially in underserved areas where traditional therapy services may be limited.

Furthermore, the multidisciplinary intervention model developed in this research serves as an example of how inclusive educational strategies can be effectively employed to address the specific needs of children with ADHD. The combination of accessible digital tools and community-based support systems contributes to fostering more equitable educational opportunities for children with speech disorders, promoting their academic and social success.

3. RESULT AND DISCUSSION

3.1. Speech Impairment in ADHD Children

Findings from the pediatrician reveal that speech disorders in children with ADHD are often secondary symptoms linked to neurodevelopmental dysfunctions affecting motor systems and language centers in the brain. In many cases, children with ADHD also experience significant delays in language development, especially in articulation and speech clarity. They often have difficulty constructing complex sentences and maintaining focus during verbal communication. Compared to previous studies, ADHD related speech disorders are more likely to present alongside other developmental concerns such as impulsivity and inattention, which complicate traditional therapeutic approaches.

Insights from the psychologist indicate that speech impairments in ADHD are closely related to attention deficits and emotional regulation issues. Children with poor impulse control and concentration tend to leave sentences incomplete, repeat unnecessary phrases, and struggle to follow verbal instructions. The psychologist emphasized the importance of early diagnosis, as delayed intervention could worsen communication difficulties and affect the child's social and academic development. This finding builds on previous research, particularly those that have focused on ADHD's impact on language development, but with an emphasis on integrating AI-based diagnostic systems to aid in early identification and intervention.

The speech therapist explained that ADHD children frequently exhibit various speech disorders, including articulation disorders, phonological disorders, and in some cases, childhood apraxia of speech (CAS). During therapy sessions, maintaining the child's attention was identified as a major challenge that reduced the effectiveness of speech therapy. Additionally, many children displayed prosody disorders such as monotone intonation, inconsistent speech rhythm, and inappropriate volume control. These issues, though consistent with earlier reports, highlight a significant gap in traditional speech therapy techniques, which do not always account for the attentional needs of ADHD children.

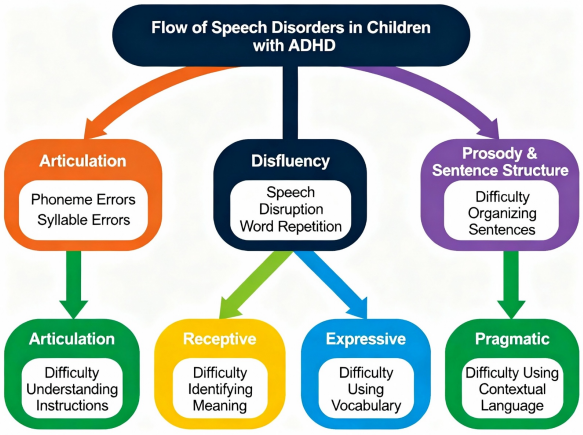

Figure 1. Forms of Speech Impairment in ADHD Children

Figure 1 illustrates the interconnected forms of speech impairments commonly found in children with ADHD. It shows three primary areas of difficulty: articulation, disfluency, and prosody and sentence structure. Articulation issues often involve phoneme and syllable errors, which can lead to challenges in understanding spoken instructions. Disfluency appears through speech disruptions and word repetitions, eventually affecting both receptive abilities such as identifying meaning and expressive abilities, including the effective use of vocabulary. Meanwhile, problems with prosody and sentence structure cause children to struggle with organizing sentences, which contributes to pragmatic difficulties, such as using language appropriately in different social contexts. Overall, the image highlights how ADHD can significantly impact a child's communication skills beyond attention and behavioural symptoms.

Meanwhile, parents shared that their children had trouble expressing themselves verbally at home. Some reported that the child preferred screaming or pointing instead of using words to communicate needs or emotions. Others mentioned the child often repeated a limited set of words, even when the conversation changed. Parents expressed concern about their child's delayed speaking abilities, which negatively impacted their ability to interact with peers and their environment. This reinforces the critical role of parental language

strategies, particularly those that can be integrated into technology driven tools for therapy support. Findings from this case study reveal that speech disorders in children with ADHD are highly diverse and complex, often intertwined with core symptoms of ADHD such as impulsivity, inattention, and hyperactivity. In-depth assessments showed that children tended to skip words, jumble sentence structures, or speak in an overly loud or monotone voice. These speech irregularities were observed both in natural home environments and in clinical settings. Informants such as pediatricians, speech-language therapists, and parents emphasized that these challenges significantly hinder communication development and peer interaction. Such findings further support the need for multidisciplinary approaches, including technology-enhanced tools for real-time language support.

Table 1. Comparison Table of Speech Disorders in Children with ADHD by Type

Speech Disorder Aspect	**Hyperactive Children**	**Inattentive Impulsive Children**	**Combined Type Children**	**Major Similarities**
Articulation	Mild to moderate articulation difficulties.	Difficulties in articulation and speech production.	Articulation difficulties present since the age of 2–3 years.	All three types exhibit articulation difficulties.
Speech Production	Excessive, repetitive, and impulsive speech.	Limited speech production, frequent errors, and difficulty imitating speech.	Fast, repetitive, and poorly controlled speech.	Difficulty regulating speech production (excessive, limited, or unstable).
Coherence & Speech Utterance	Messages are disorganized and lack coherence.	Responses are brief, with difficulty forming complete sentences.	Irregular topic shifts and inaccurate word choices.	Difficulty constructing coherent and well-structured utterances.
Conversation Topics	Frequently interrupt and shift topics quickly.	Unable to stay on one topic for an extended period.	Chaotic topic shifts, often out of context.	Difficulty maintaining conversation topics.

Table 1 presents a comparative overview of speech disorder characteristics across the three primary ADHD subtypes, namely Hyperactive, Inattentive Impulsive, and Combined Type. The pediatrician noted that delayed verbal development is often exacerbated by poor attention spans and difficulty following structured speech patterns, which align with findings [46, 47]. Meanwhile, the speech therapist highlighted the need for multi-sensory therapy approaches tailored to the child's unique cognitive and linguistic profile. Parents reported frustration over their children's inability to express emotions effectively, leading to tantrums or withdrawal [48].

By synthesizing the data from observation and interviews, it can be concluded that speech disorders in children with ADHD include articulation difficulties, disfluency, phonological processing issues, and limitations in pragmatic and prosodic language use. The combination of neurological challenges associated with ADHD and lack of timely intervention intensifies the complexity of speech impairments in these children. Therefore, a holistic and interdisciplinary understanding is essential for effective treatment and support. This research advocates for the development of technology-based tools, such as AI-driven diagnostic platforms, to better support clinicians and caregivers in addressing these speech disorders at an early stage. Speech disorders in children with ADHD encompass a broad spectrum ranging from motor planning deficits to pragmatic dysfunctions and require comprehensive, interdisciplinary intervention strategies. These findings support prior research asserting the need for early, sustained, and individualized therapy plans. Accurate identification of speech difficulties through collaborative diagnostics is crucial for facilitating effective communication and long-term development in children with ADHD.

3.2. Intervention for Speech Disorders in Children with ADHD

Intervention for speech disorders in children with ADHD requires a structured and multidisciplinary approach. The research aims to develop a comprehensive intervention model specifically designed to address the unique challenges faced by children with ADHD who also experience speech difficulties. This model combines conventional speech-language therapy techniques with behavioural management strategies and environmental modifications tailored to the neurodevelopmental profile of children with ADHD. The proposed model emphasizes the use of technology, such as digital therapy apps, which can be tailored to each child's individual needs, making interventions more personalized and scalable.

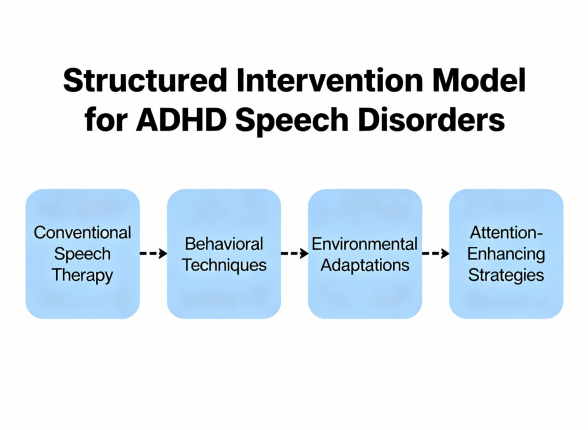

Figure 2. Intervention for Speech Disorders

Figure 2 speech disorders in children with ADHD are not only related to deficits in language processing but are also heavily influenced by their core behavioural symptoms of inattention, impulsivity, and hyperactivity [24, 27]. Therefore, traditional speech therapy alone may not yield optimal results unless it is adapted to the attentional and behavioural needs of the child.

The intervention model proposed in this study incorporates several key components:

- Conventional speech therapy to address articulation, fluency, and receptive-expressive language issues.
- behavioural techniques, such as token systems, visual schedules, and immediate reinforcement, to help manage impulsivity and maintain focus during therapy sessions.
- Environmental adaptations, including minimizing distractions in the therapy room, using visual and auditory cues, and providing frequent breaks to prevent cognitive overload.
- Attention-enhancing strategies like breaking tasks into small, achievable steps and using interactive, multisensory learning tools such as speech-based apps and games to maintain engagement.

The structured program will be supported by a detailed implementation manual, which includes session planning guides, therapy materials (flashcards, picture boards, auditory input tools), and progress evaluation tools to track improvements in speech production and communication skills. Each component of the intervention is designed with flexibility in mind, allowing therapists to adjust based on the individual child's progress and response.

Moreover, collaboration with caregivers and educators is emphasized as an integral part of the model. Parents and teachers will receive training on how to support language development and behavior regulation at home and in school settings. This family-centered approach ensures continuity of care and reinforcement of therapy goals beyond clinical settings. The integration of digital tools in this approach will enable parents and teachers to track progress and receive guidance remotely, making the intervention more accessible and scalable.

Table 2. Intervention for Speech Disorders in Children with ADHD

Type of Speech Disorder	**Intervention Model / Approach**	**Techniques & Specific Strategies (Therapists & Parents)**
Articulation Disorder	Multi-sensory Approach & Motor Skills	• Multi-sensory stimulation integrating visual (mirror/pictures) and auditory cues. • Impromptu production practice using slow, repeated articulation. • Parental modeling to provide accurate articulation models at home.
Speech Production Control Disorder (Excessive / Limited / Unstable Utterances)	Fernald Method & Self-Regulation	• Fernald Method with visual, auditory, tactile, and kinesthetic inputs. • Stop and Think technique, encouraging children to pause before responding. • Visual timer to regulate turn-taking for excessive speech. • Gradual sentence patterning to build sentence structure step-by-step.
Difficulty in Constructing Sequential and Coherent Utterances	Narrative Intervention	• Story structure instruction (characters, setting, problem, solution). • Visual aids using sequencing cards. • Storytelling habits and retelling practices using conjunctions (first, then, finally).
Difficulty Maintaining Conversational Topics	Context-Based Learning	• Child-interest topics to initiate conversations. • Concrete objects (dolls or real items) to visualize discussion topics. • Open-ended questions such as "Tell me about...". • Visual supports to help maintain focus and prevent topic shifting.

Table 2 provides a comprehensive overview of intervention models and specific therapeutic strategies designed to address various speech disorders commonly observed in children with ADHD. The table highlights how different speech challenges ranging from articulation difficulties to impaired speech production control, weak narrative coherence, and conversational topic maintenance require distinct yet complementary approaches. Each intervention model, such as the Multi-sensory Approach, Fernald Method with self-regulation components, Narrative Intervention, and Context-Based Learning, is paired with targeted techniques that support children's expressive and receptive language development. As shown in Table 2, these strategies include multi sensory stimulation, structured sentence patterning, guided storytelling, visual supports, open ended questioning, and parental modeling, all of which work synergistically to enhance communication abilities. Collectively, the interventions serve not only to remediate specific speech deficits but also to foster sustained improvement through consistent therapeutic and home-based practices.

3.3. Parental Language Parenting to Overcome Speech Impairment in ADHD Children

Language parenting by parents plays an important role in supporting the success of speech disorder intervention in children with ADHD. Based on the results of a study that included in-depth interviews with pediatricians, psychologists, speech therapists, and parents, it was found that communication patterns and the verbal environment at home have a significant influence on the language and speech skills of ADHD children. The role of parents in reinforcing the speech therapy process through digital tools and apps is critical, as these tools help guide parents in real-time interactions with their children.

In addition, parental involvement becomes even more impactful when integrated with digital or technopreneurial tools designed to support language development in children with ADHD. Mobile applications that provide visual schedules, emotion cards, speech-modeling videos, or interactive storytelling features enable parents to deliver structured linguistic input even without formal training in speech therapy. These tools act as real-time guides, helping parents apply evidence-based techniques at home while monitoring their child's progress. As demonstrated in Figure 3, the combination of simple communication, visual strategies, emotional support, and communication routines creates an enriched and supportive environment that aligns with children's cognitive needs. This synergy between parental practices and digital aids ensures that intervention continues beyond the clinic, fostering continuous, accessible, and engaging language development for children with ADHD.

Figure 3. Parental Language Parenting to Overcome Speech Impairment in ADHD Children

Figure 3 illustrates the five core principles of language parenting that play a crucial role in supporting children with ADHD who experience speech disorders. The visual highlights key strategies such as simple and consistent communication, wait time, visual strategies, emotional support, and communication routines. These principles align with evidence from speech language pathology and developmental psychology, emphasizing that children with ADHD benefit significantly from environments that reduce cognitive load, provide behavioural models, and offer predictable communication patterns. By simplifying instructions, offering sufficient response time, and reinforcing comprehension through visual cues, parents can create a more structured and supportive communication context that accommodates the attentional and processing challenges commonly found in ADHD.

Furthermore, Figure 3 shows how emotionally supportive interactions and routine communication activities contribute to long-term improvements in expressive and receptive language skills. Techniques such as daily storytelling, interactive reading, or singing together establish repetitive and meaningful linguistic exposure that strengthens neurological pathways related to speech and language development to the aforementioned strategies.

Table 3. Language Parenting Strategies for Children with ADHD

No	Language Parenting Aspect	Description	Goal/ Impact	Implementation Example
1	Intensive Communication	Parents actively communicate with children with ADHD using concise, brief, and clear sentences.	Helps children understand instructions, expand vocabulary, and build focused communication.	Using sentences such as "Let's take that red ball" while pointing to the object.
2	Multi-sensory Stimulation	Engaging children in activities that involve various senses (visual, auditory, tactile).	Strengthens sensory connections and accelerates the language learning process.	Singing while playing, picture guessing games, or building blocks while naming colors.
3	Reading and Story Telling Habits	Reading stories with expressive intonation and engaging illustrations on a regular basis.	Enhances children's receptive and expressive abilities and expands imagination and vocabulary.	Using picture books, asking children to predict the story, or repeating key vocabulary.
4	Positive Reinforcement	Giving praise and encouraging responses to children's communication efforts.	Increases motivation and boosts children's confidence in speaking.	Saying "Great, you said it clearly!" or "Excellent! You can say 'water'."
5	Consistency in Language Stimulus	Applying repetitive and consistent language-related practices at home.	Builds structured communication habits and reinforces speech therapy progress.	Scheduling daily speaking/ play sessions, such as 30 minutes every afternoon.
6	Therapeutic Support Through Continued Stimulation	Parents collaborate with speech therapists to continue therapy-based practices at home.	Ensures continuity of therapy so progress becomes more significant.	Practicing articulation exercises similar to those performed in clinic sessions.
7	Guided Social Interaction	Creating a supportive environment that encourages interaction with peers.	Develops pragmatic and social communication abilities.	Organizing small-group play sessions with parental guidance.
8	Reducing Distractions (Screen Time)	Limiting excessive exposure to gadgets and television.	Prevents vocabulary loss and loss of focus caused by passive stimulation.	Allowing a maximum of 30 minutes of screen time per day with parental supervision.

The language parenting strategies summarized in Table 3 illustrate how structured parental involvement plays a critical role in supporting communication development among children with ADHD through a variety of targeted approaches. These strategies encompass intensive communication, multisensory stimula-

tion, storytelling habits, positive reinforcement, consistency in language exposure, therapeutic collaboration, guided social interaction, and controlled screen time. Each component is designed to strengthen children's receptive and expressive language abilities while simultaneously improving attention, motivation, and social communication skills.

4. MANAGERIAL IMPLICATION

4.1. Integrating Technopreneurial Innovations in Speech Therapy

The study underscores the importance of integrating technopreneurial innovations such as AI-based diagnostic tools and speech therapy apps into traditional therapeutic models for children with ADHD. These technology driven solutions are essential for scaling up access to speech therapy, particularly in underserved areas where healthcare and therapeutic services are limited. By leveraging digital tools, therapists and educators can personalize interventions for children, thereby improving the efficacy of treatment plans. For managers in healthcare and education, adopting these innovations can significantly enhance service delivery, improve treatment outcomes, and reduce the cost and time involved in therapy.

4.2. Enhancing Parental Involvement through Digital Platforms

A significant finding from this study is the strategic role of parental involvement in the success of speech therapy for children with ADHD. Parents, when equipped with the right tools and knowledge, can actively contribute to their child's speech development at home. Digital platforms, such as language parenting apps and interactive guides, enable parents to easily implement and reinforce therapy techniques learned in clinical settings. For education managers and healthcare providers, this presents an opportunity to develop and offer digital training programs for parents, enhancing their involvement and creating a holistic support system for the child.

4.3. Policy and Managerial Support for Multidisciplinary Collaboration

The research highlights the need for a multidisciplinary approach in addressing speech disorders in children with ADHD, involving not only therapists but also parents, educators, and technopreneurs. Managers in healthcare and education must foster collaboration between these key stakeholders to create an integrated intervention model. This model should combine conventional speech therapy, behavioural management techniques, and technopreneurial solutions that cater to the child's individual needs. By establishing strong partnerships between these sectors, organizations can create more effective, personalized interventions that target both the child's speech development and behavioural regulation.

5. CONCLUSION

This study highlights the need for a structured and holistic intervention approach to address speech disorders in children with ADHD. It emphasizes the integration of tailored speech therapy with the active involvement of parents through effective language parenting practices. This combination ensures a more personalized and comprehensive intervention that addresses both the clinical and environmental factors influencing the child's speech development, while also supporting global goals for child well-being and inclusive education.

The intervention model developed in this study has proven effective when reinforced by home-based communication strategies. These include using simple language, applying language stimulation techniques, and providing emotional support to encourage the child's verbal development. The consistency of these strategies in the home environment significantly enhances the impact of therapy and promotes long-term improvements in the child's communication skills, thereby contributing to SDGs 3 (Good Health and Well-being) through better developmental outcomes and improved access to holistic care.

Additionally, the creation of a comprehensive database on speech characteristics in children with ADHD offers valuable insights for future research and the development of more accurate assessment tools. This resource lays the foundation for advancing both diagnostic and intervention practices in the field. The study also reinforces SDGs 4 (Quality Education) by promoting inclusive educational practices, empowering parents and teachers with evidence based strategies, and supporting the development of early identification tools that enhance learning accessibility for children with special needs. Ultimately, the research underscores the importance of collaboration among therapists, parents, teachers, and policymakers to ensure the sustainability and success of speech interventions for children with ADHD across various educational and clinical settings.

6. DECLARATIONS

6.1. About Authors

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6.2. Author Contributions

Conceptualization: UH; Methodology: IZ; Software: SS; Validation: YE, IV and UH; Formal Analysis: IZ and SS; Investigation: YE; Resources: UH; Data Curation: SS; Writing Original Draft Preparation: IZ and YE; Writing Review and Editing: UH, IV and IZ; Visualization: SS; All authors, UH, IZ, SS, YE and IV have read and agreed to the published version of the manuscript.

6.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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6.5. Declaration of Conflicting Interest

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