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Artificial intelligence media-assisted storytelling therapy as a solution for handling speech delay in early childhood

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ABSTRACT

This study investigates the effectiveness of Gemini AI-assisted storytelling therapy as an innovative approach to addressing speech delays in early childhood. Through qualitative methodology incorporating case studies, literature review, and action research with children aged 6-8 years, participants engaged in therapeutic storytelling sessions facilitated by Gemini AI, which generated personalized narratives based on individual abilities while providing real-time analysis of verbal responses. The AI system's adaptive algorithms continuously refined story content to match each child's developmental progress, creating an engaging learning environment throughout the intervention period. Sessions gradually increased linguistic complexity while incorporating children's preferences, fostering both communicative skills and emotional investment. Data collection included pre- and post-intervention assessments, recorded therapy sessions, parental interviews, and AI-generated progress reports tracking specific speech parameters. Results demonstrated significant improvements in vocabulary acquisition, sentence structure, and speaking confidence, with children exhibiting increased engagement during sessions while scheduling flexibility enhanced parental involvement. The findings confirm that AI-assisted storytelling therapy represents an effective intervention for speech delays, as the personalized content and real-time assessment capabilities complement traditional speech therapy approaches, potentially expanding accessibility to quality intervention while providing a scalable solution for the growing demand for specialized speech services.

Introduction

Speech delay in children ages 40–60% (Morgan et al., 2017). This phenomenon has increased after the COVID-19 pandemic, which brought significant changes in daily life patterns, including increased use of gadgets. Excessive use of gadgets has reduced children's social interactions and physical activities, hurting speech and language development. Delays in language development have severe long-term impacts, especially in academics. Children with difficulty speaking or understanding language will face obstacles in following lessons and interacting with peers. This can lead to greater learning difficulties and lower self-confidence in the long term. In addition, speech delays also impact children's social and emotional development, hindering their ability to form healthy relationships and express themselves (Badawieh & Al-Shamsi, 2023). Six types of speech delays cover various aspects of language ability, namely: (1) speech

and/or language, (2) language only, (3) speech only, (4) expression with understanding, (5) expression only, and (6) understanding only (Law et al., 2010). This classification is important for determining the type of therapy appropriate for each child, considering their needs vary greatly. For example, a child with difficulty with expression alone will require a different approach than one with difficulty understanding language.

Language or speech delay refers to slower development than peers, while language or speech disorders refer to deviations from standard developmental patterns (CDCP, 2019). Language disorders can include form (phonology, morphology, syntax), content (semantics), and communication function (pragmatics), while speech disorders relate to difficulties with pronunciation or fluency (Wallace et al., 2015). Both conditions can occur separately or together and are at risk for learning disabilities, including reading and writing difficulties (Jullien, 2021) and behavioral and psychosocial problems that can persist into adulthood (Siu, 2015).

Language and speaking abilities are influenced by intrinsic factors, such as congenital conditions and the physiology of the speech organs, as well as extrinsic factors, such as environmental stimulation (Akbar & Ismail, 2021). Therefore, language delays and disorders in children are complex problems that require attention and early intervention so that children can develop their potential optimally. In Indonesia, many children with speech delays do not receive adequate attention from their parents. This is due to a lack of knowledge about the importance of linguistic stimulation and limited access to health services (Hasanah & Sugito, 2020). In addition, poor parenting skills are also a contributing factor. Many parents do not yet know how to communicate and introduce new vocabulary to their children effectively.

Economic factors also worsen the situation. Families with low economic conditions generally have limited access to the resources needed to support child development (Xue & Li, 2020). In addition, the level of parental education also has a significant influence. Parents with higher education tend to understand the importance of language stimulation better and are better able to provide an environment that supports child development. Conversely, parents with lower education generally have less understanding of the importance of verbal interaction and have limited access to information about child development (Muluk et al., 2020).

Although various approaches have been applied to address speech delay in early childhood, there are still limitations in the effectiveness and personalization of the methods used. Previous studies have shown that music-based approaches (Vries, 2008; Christiner, 2018), picture media (Aprinawati, 2017), role-playing (Fika et al., 2019), thematic comics (Ruiyat et al., 2019), and singing (Ardianti et al., 2021) provide positive contributions to children's language development. However, most of these methods are one-way, less interactive, and have not been fully adapted to each child's individual needs. For example, music and singing can stimulate rhythm and language repetition but cannot adapt to children's speech development. Picture media and comics enrich vocabulary but do not encourage dynamic verbal interaction.

Meanwhile, role-playing requires intensive involvement from therapists or companions and is challenging to apply flexibly in various situations. In response to these shortcomings, this study offers a new approach through artificial intelligence (AI)-assisted storytelling therapy. AI can overcome various challenges faced by students (Rahmawati et al., 2025). AI can help accessibility for children with special needs (Chamalah et al., 2024). This approach combines the power of narrative with technology to deliver interactive, flexible, and personalized interventions. AI allows for real-time adjustment of story content to suit the child's abilities, interests, and responses. Thus, this therapy improves language skills and provides a fun and relevant experience for each child's development. In addition to developing innovative approaches, support from the community and government is also critical. Providing affordable and easily accessible health services, educational programs for parents, and awareness campaigns about the importance of language development need to be continuously promoted. The government can play a role through early intervention programs that help identify and treat speech delays early on and provide training for parents to support optimal language development in the home environment.

The challenges of speech delays in early childhood require close collaboration between parents, educators, and health professionals. This collaboration is essential to create an environment that supports optimal language development in children. With the proper support, children can improve their academic abilities and grow into confident individuals who can contribute positively to society. Therefore, educators need to have a deep understanding and seriousness in dealing with speech delays from an early age. One practical approach is storytelling therapy. Storytelling is one of the oldest methods of human communication, and one of the oldest modes of teaching (Landrum et al., 2019). Literary works such as fairy tales are beneficial in the world of education because, in addition to conveying knowledge, storytelling activities can also increase self-confidence and build interpersonal relationships (Saxby 2022). Storytelling therapy is not a new concept; it has previously been used in various contexts, such as community projects, health promotion, disease prevention, and psychological therapy to overcome sadness (Parker & Wampler, 2010). This therapy can be applied to toddlers and preschoolers, although its effectiveness tends to be

higher in preschoolers with more developed imaginations (A'diilah & Irman, 2016). Literary therapy provides space for emotional expression and symbolic experiences that cannot be expressed verbally (Haeyen et al., 2020; Kim et al., 2022). Community-based literary therapy interventions have shown significant results in improving the psychological well-being and social engagement of individuals with developmental disorders. Literature is able to give an impression to readers (Hidayat & Santoso, 2019; Chamalah & Nurryati, 2023).

With the advancement of technology, storytelling therapy can now be further developed using Artificial Intelligence (Lilywhite & Wolbring, 2021). AI is a form of artificial intelligence that allows computers to perform cognitive tasks like humans (Roca at al., 2020; Samim, 2023). In addition, AI is also often used for disability rehabilitation (Kaelin et al., 2021). Through the application of AI-assisted storytelling therapy, it is hoped that it can be used as an alternative solution that is more innovative and personal in handling speech delays in early childhood. Early childhood itself is defined by the Depdiknas (2008) as children aged 0–6 years. However, several experts, such as Rosyad & Zuchdi (2018), expand this definition to the age of 8 years. Mansur (2005) emphasized that early childhood is an individual in a unique phase of growth and development, so it requires comprehensive and balanced guidance in physical, cognitive, social-emotional, language, and communication aspects. This opinion is reinforced by Hartoyo (2004), Suryadi (2019), and Risman et al. (2023), who call this age the golden age of child growth. Therefore, proper stimulation during this period is significant in determining the overall development of a child's potential (Khotimah & Agustini, 2023). Based on this background, this study formulated two main things, namely (1) the identification of storytelling therapy media assisted by Artificial Intelligence as a solution for handling speech delays in early childhood and (2) the contribution of understanding to teachers and the community that storytelling therapy media assisted by Artificial Intelligence can be used as a solution in handling speech delays for early childhood.

Method

This study uses a qualitative approach to deeply understand the process and effectiveness of artificial intelligence (AI)--assisted storytelling therapy in treating speech delays in early childhood. This approach was chosen because it allows for holistic exploration of phenomena through direct interaction with the subject and its context so that the data obtained is richer and more meaningful. Three primary methods were used to support this objective: case studies, classroom action, and literature studies. First, a case study was applied to intensively observe the development of children aged 6–8 years who experienced speech delays after undergoing AI-based storytelling therapy. Data were collected through participatory observation, in-depth interviews with parents and teachers, and systematic documentation of therapy activities. Through this case study, researchers can understand individual changes in detail, including factors that support or hinder children's language development. Second, the classroom action method was used to implement and evaluate storytelling therapy in the context of elementary school learning. The study was conducted in two cycles: planning, implementation, observation, and reflection. This approach allows researchers to continuously improve therapy strategies based on findings in the field and measure their effectiveness gradually. Third, a literature study was conducted to strengthen the theoretical basis and develop an evidence-based intervention framework. This study covers literature on children's language development, speech delay, storytelling therapy methods, and AI integration in early childhood education. The literature review results were used to compare the research findings with previous study results and enrich the analysis. Through the combination of these three methods, this study is expected to provide a comprehensive picture of the effectiveness of AI-assisted storytelling therapy and its contribution to efforts to intervene in speech delay in children.

Research Techniques

The data in this study were collected through three main techniques: participant observation, in-depth interviews, and document analysis related to language development and speech therapy. Participant observation was conducted to observe the communication behaviour of children with speech delays in various situations, both at home, at school, and during AI-based storytelling therapy sessions. Through this observation, researchers identified patterns of interaction, verbal and nonverbal responses, and symptoms of speech delays that appeared in the child's daily life. Observations were conducted in a structured manner using observation sheets to ensure the consistency of the data collected. In-depth interviews involving parents, elementary school teachers, principals, and therapists were conducted semi-structured. The interviews aimed to explore their experiences, perceptions, views, and challenges in dealing with speech delay cases in children. In addition, the interviews also explored informants' responses to the use of AI-assisted storytelling therapy, including ease of use, perceived benefits, and technical obstacles faced during implementation. Document analysis included a review of medical reports, child development records,

documentation of therapy activities, and the results of routine evaluations conducted by teachers or therapists. These documents provide an objective picture of the child's condition before, during, and after the therapy intervention and support the triangulation of data obtained from observations and interviews. Data Collection Procedure Data collection began with obtaining official permission from the child's parents or guardians and approval from the school's principal where the research took place. After complete permission, observations were conducted periodically during therapy sessions at school and the child's daily activities at home, with the family's consent. Interviews were conducted separately with each informant, using a previously prepared interview guide to maintain focus and completeness of the data. Each interview session was recorded (with the informant's consent) to ensure the accuracy of the transcript. Document analysis was carried out systematically on medical records, progress reports, and other relevant documentation to complement the primary data obtained through observation and interviews.

Data Analysis Technique

Data were analysed using inductive qualitative analysis techniques. The analysis process followed the model of Miles & Huberman (2007), Creswell (2018), and Archibald & Onwuegbuzie (2020) which includes four main stages: (1) data collection, (2) data reduction, (3) data presentation, and (4) concluding. The collected data was coded and categorized into central themes: causes of speech delay, the effectiveness of AI-based storytelling therapy, and challenges in implementing therapy. Analysis was done repeatedly to find significant patterns, relationships, and dynamics among the data.

Data Validity

To ensure data validity, the researcher applied the source triangulation technique by comparing and combining data from observations, interviews, and document analysis. In addition, member checking was carried out by asking for feedback from informants to verify the correctness of the data interpretation made by the researcher. This technique aims to ensure that the research results reflect the reality experienced by the informants and strengthen the validity of the findings obtained.

Results and Discussion

Research on speech delay has been widely conducted, including by Budiarti et al. (2023), who used the storytelling method, Rahmah et al. (2023) with speech therapy, and Nisma & Ramly (2024) through the DIR approach. This study is different from previous studies, namely by developing storytelling therapy to deal with speech delay in elementary school children, especially students in grades 1 and 2 aged 6–8 years. Based on the results of interviews with several teachers and principals in elementary schools, speech delay in children is often caused by lack of parental support, less than optimal parenting patterns, and low family socio-economic conditions. These factors impact low awareness and involvement in handling speech delays. On the other hand, based on a case study, when the researcher accompanied the school mover program for approximately 4 years, teachers admitted that they had difficulty providing special assistance due to limited time and competence in dealing with children with special communication needs. Therefore, collaboration between teachers and parents is needed in intervention efforts. One solution that can be implemented together is storytelling therapy because this method is relatively easy to do and fun and can be implemented both at home by parents and at school by teachers.

Artificial Intelligence-Assisted Storytelling Therapy Media as a Solution to Handling Speech Delay for Early Childhood

Artificial intelligence (AI)(Seo et al., 2021)-assisted storytelling therapy media can be an innovative solution in handling speech delay in early childhood (Abdulov, 2020; Fauziddin & Agustin, 2024). This therapy is carried out through several systematic stages designed to stimulate children's language skills interactively and enjoyably. The process begins with selecting a story appropriate to the child's age, interests, and language abilities. The teacher chooses a simple, illustrated, and easy-to-understand fairy tale with the help of Gemini AI. Gemini AI technology recommends the right story based on the child's profile, helps simplify the text, and adjusts it adaptively according to individual needs. In addition, Gemini AI can periodically change the choice of stories based on the child's language development so that the fairy tale material remains relevant and challenging. After selecting the story, the next stage is a joint reading activity. The teacher and students read the selected fairy tale, with the teacher using facial expressions, intonation, and movements that attract the child's attention. This emotional involvement is essential for building a positive relationship with the story and encouraging children to participate actively. The third stage is a pre-reading discussion. The teacher asks reflective questions such as, "What would you do if you were the main character in this story?" This discussion aims to activate prior knowledge, expand imagination, and build children's involvement before listening to the story. In the fourth stage, an interactive storytelling

session is held. Children are invited to imitate the character's voice, guess the storyline, or answer simple questions that arise during the story. This activity trains speaking skills and strengthens children's memory and language logic.

After the storytelling session, children are asked to retell the story using their language. The teacher provides support, such as showing pictures related to the story to help children remember new vocabulary and organize story ideas sequentially. The use of Gemini AI in this stage also includes providing additional activities such as interactive quizzes or story modification suggestions that can improve children's imagination and creative thinking skills. Children are encouraged to create their version of the ending, thus encouraging richer personal expression. In the advanced stage, the story is repeated with variations in the storyline to sharpen understanding, expand vocabulary, and improve speaking fluency. The teacher provides positive reinforcement through praise, virtual badges, or motivation for each child's participation to build self-confidence. Simple evaluations are also conducted, such as asking children to name the main characters, story settings, or conflict resolution plots. This activity helps teachers monitor children's language development systematically. In addition, children are invited to draw or write the parts of the story that they like the most as a form of creative expression. The children's work is then documented to monitor the progress of therapy over time. It is recommended that this therapy be carried out 2-3 times a week for about 30 minutes per session. Consistency and patience are the keys to optimal results in stimulating early childhood language development.

The effectiveness of AI-assisted storytelling therapy is further supported by recent interdisciplinary research highlighting the role of technology in enhancing early childhood learning. According to Clemente-Suárez et al. (2024), digital storytelling using interactive platforms can foster emergent literacy by increasing children's engagement, attention span, and narrative comprehension. Moreover, children benefit cognitively and linguistically when digital stories are accompanied by adult mediation, such as prompting and guided questioning—components that are deeply embedded in AI-assisted therapy sessions. Additionally, research by Silvia & Jayanegara (2024) underscores how adaptive AI tools personalize language learning based on real-time feedback and learner profiles, thus making therapy more responsive to individual developmental trajectories. These findings align with the therapeutic structure outlined earlier, where Gemini AI dynamically modifies the story content to match children's progress and interests. Beyond language outcomes, the integration of technology with socioemotional scaffolding—like praise and peer interaction—helps create a supportive environment conducive to expressive language growth. As such, AI-assisted storytelling not only serves as a language intervention strategy but also functions as a holistic educational approach rooted in personalized, culturally relevant, and emotionally engaging learning experiences.

Contribution of Understanding to Teachers and the Community Regarding Artificial Intelligence-Assisted Storytelling Therapy Media as a Solution in Handling Speech Delay for Early Childhood

Contribution of Understanding to Teachers and the Community regarding Artificial Intelligence-Assisted Storytelling Therapy Media as a Solution in Handling Speech Delay for Early Childhood To contribute to the understanding of teachers and the community regarding the use of artificial intelligence (AI)-assisted storytelling therapy media as a solution to handling speech delay in early childhood, several strategic steps were taken. First, education was provided about children with speech delays, including general characteristics, causative factors, and their impact on their social, emotional, and academic development. Teachers and the community need to understand that early detection and appropriate treatment can significantly improve the prognosis of children's language development. Second, socialization was carried out regarding storytelling therapy as an effective and enjoyable language stimulation method. Emphasis was placed on the benefits of storytelling in enriching vocabulary, training sentence structure, improving the ability to understand the storyline, and building children's confidence in communicating. Third, the role of AI in supporting storytelling therapy was explained in detail. Technologies such as Gemini AI cannot only select stories based on the child's development profile but also adjust the level of language difficulty and offer interactive recommendations to maintain child engagement during the storytelling session. Fourth, the advantages of using AI in therapy are presented, such as flexibility in time and place, personalization of materials based on individual child progress, and the ability to monitor language development through AI-based analytical features automatically.

This makes therapy more adaptive and data-driven, so teachers and parents can make more informed decisions supporting child development. Fifth, a communicative and collaborative approach is applied to teachers and the community through training, seminars, workshops, and community service activities. Each activity is designed so that participants receive information and gain direct experience in trying this therapy

media. Sixth, collaboration is built with psychologists, speech therapists, and child education experts to strengthen the interdisciplinary approach to handling speech delays. This collaboration aims to ensure that AI-based storytelling therapy media can be integrated with traditional therapies that have proven effective. As part of the evaluation and feedback efforts, researchers distributed questionnaires to teachers and parents of students to determine their level of understanding, interest, and response to the application of this media. The questionnaire results showed that 84% of teachers stated they gained new insights into the benefits of AI-based storytelling therapy, and 78% felt more confident trying the media in the classroom. On the other hand, 82% of parents stated that their children seemed more enthusiastic when listening to stories involving AI. In comparison, 75% of parents observed an increase in their children's ability to name new vocabulary after undergoing regular therapy. These data indicate that the education and training provided have increased teachers' and the community's awareness, understanding, and acceptance of this innovative approach to treating speech delay.

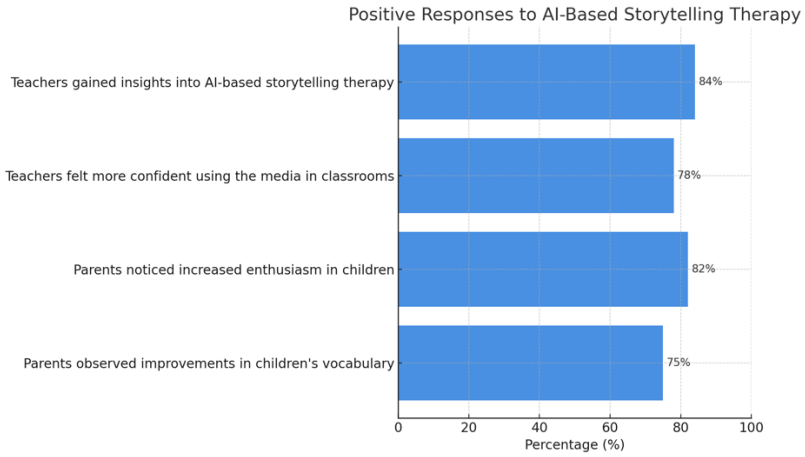

Fig. 1. Diagram Respon AI-Base Storytelling Therapy

Fig. 1. suggests these findings resonate with Vygotsky's sociocultural theory, which emphasizes the important role of social interactions and cultural tools in cognitive development. The integration of AI storytelling therapy serves as a mediating tool that enhances children's language acquisition within their zone of proximal development (ZPD). Furthermore, this aligns with the theory of multimedia learning by Mayer, which suggests that combining verbal and visual inputs—such as those found in AI storytelling—can significantly enhance comprehension and retention in young learners. Prior studies, such as those by (Alazemi, 2024; Hutson & Schnellmann, 2023), have shown that AI-assisted educational tools can increase engagement and promote individualized learning experiences. The observed increase in vocabulary and enthusiasm supports these theoretical frameworks and empirical findings. The interdisciplinary and community-based approach also reflects Bronfenbrenner's ecological systems theory, which posits that a child's development is influenced by multiple layers of environmental systems, including family, school, and community. By involving educators, parents, and specialists, the therapy initiative reinforces a holistic, inclusive strategy for supporting children with speech delays.

Recent studies have further substantiated the benefits of AI-assisted storytelling in therapeutic contexts. For instance, Chang et al. (2023) conducted a randomized controlled trial demonstrating that robot-assisted digital storytelling significantly reduced anxiety and enhanced communication among hospitalized children undergoing intravenous procedures. Similarly, Du et al. (2019) introduced 'Storytime,' an interactive mobile application employing a virtual avatar to facilitate speech and language screening in children aged 4 to 6. Their proof-of-concept study revealed that children engaged effectively with the virtual avatar, suggesting the potential of such tools in early detection and intervention of speech and language delays. These findings align with the current study's results, indicating that AI-based storytelling not only increases engagement but also serves as a viable medium for therapeutic interventions in pediatric populations.

Conclusion

Artificial intelligence (AI)-assisted storytelling therapy provides a fun and creative alternative in early childhood vocabulary learning and language development, especially for children with speech delays. This approach offers a more interactive learning experience and helps children build confidence in speaking. This therapy process involves several critical stages, such as selecting fairy tales that are appropriate to the

child's age and needs, expressive shared reading, interactive discussions about the content of the story, and various post-storytelling activities that aim to stimulate the child's imagination, understanding, and ability to speak actively. The support of AI technology allows the personalization of stories based on the child's interests and development and monitoring the child's response more effectively through data-based analysis. Thus, this therapy can be applied flexibly in schools by teachers and at home by parents, thereby expanding access to consistent and sustainable interventions. In addition, through systematic education efforts for teachers, parents, and the broader community regarding speech delay conditions and the benefits of using AI in storytelling therapy, a more appropriate, practical approach will be created that can improve overall therapy results. However, this study has several limitations, including the limited number of subjects observed, the relatively short duration of therapy implementation, and the use of only one type of AI platform, Gemini. Therefore, further research is expected to involve more participants from various backgrounds, and it will be conducted over a more extended period to observe long-term impacts and explore other potential AI platforms to increase the variety and effectiveness of storytelling therapy. Further research can also focus on developing AI-based therapy modules that are more structured, applicable, and easily accessible to teachers, parents, and professional therapists.

Declarations

Author contribution	:	Evi Chamalah was responsible for the entire research project. She also led the writing of the manuscript and the collaboration with the second author. Aida Azizah participated in the data collection, transcription and analysis. Yosi Wulandari and Oktarina Puspita Wardani participated in revising the manuscript. All four authors approved the final manuscript.
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