



AUDIOVISUAL BASED INTERVENTIONS FOR PROMOTING LANGUAGE AND SPEECH DEVELOPMENT IN CHILDREN: A SCOPING REVIEW

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ABSTRACT

Language stimulation is essential for children's language development. Advances in technology have promoted the use of audiovisual tools in language development interventions. Numerous studies have explored technology based language interventions, existing literature lacks an integrated overview of how different audiovisual tools contribute to children's language outcomes. This review aims to identify and categorize various audiovisual interventions that have been employed in previous studies to enhance children's language abilities. A scoping review methodology was applied, following the PRISMA 2020 protocol. Articles were sourced from three databases—Scopus, PubMed, and EBSCO—based on the inclusion criteria of open-access, full-text, English-language articles published between 2020 and 2025, focusing on language development interventions in children aged 2–12 years. A total of 7.313 records were identified, and 13 studies met the inclusion criteria for analysis. The review identified three main types of audiovisual interventions: Socially assistive robots, augmented reality, and mobile assisted language learning. These interventions have been shown to improve various aspects of children's language abilities, including articulation, vocabulary, and learning engagement. Audiovisual-based interventions have the potential to support children's language development. The findings of this review may serve as a basis for educating parents and healthcare professionals about children's language development.

Keywords: augmented reality; child; language development; mobile assisted language learning; school aged; socially assistive robots

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INTRODUCTION

Delays in language and speech development are among the most frequently observed developmental challenges in children (Puspita et al., 2019). These delays are defined as a lag in the child's speaking abilities, characterized by speech sound errors that are inappropriate for the child's age (Sunderajan & Kanhere, 2019). Delays in language and speech development can serve as early indicators of intellectual disabilities, autism spectrum disorder, and learning difficulties (Kumar & Goundar, 2022). Language and speech delays are a global concern. In Canada, the prevalence of such delays among toddlers was reported to be 12.6% in 2016 (Collisson et al., 2016), while in Thailand, 40.9% of toddlers were suspected of having such delays (Rithipukdee & Kusol, 2022). Similarly, a study in South Korea involving early school-age children revealed high prevalence rates: 35.6% for receptive vocabulary delays, 27.6% for expressive vocabulary delays, and 6.04% for speech delays (Lee & Choi, 2024). In Indonesia, data from the Indonesian Pediatric Society (IDAI) in 2013 showed that the prevalence of speech delay in preschool-aged children reached 5–8%, and this figure is estimated to increase annually (IDAI, 2013). One of the contributing factors to this issue is inadequate language stimulation.

With the advancement of technology, interventions involving audiovisual media are increasingly being utilized as tools to stimulate children's language and speech development. Previous studies have identified audiovisual content as an effective medium for supporting language development in

children (Gowenlock et al., 2024). Children are naturally drawn to audiovisual materials due to their engaging and visually appealing features (Neuman et al., 2020). Preschool learning environments that stimulate multiple senses and present rich visual content have been shown to positively influence language acquisition in young children (Miles & Ehri, 2017). This aligns with the findings of Demirdağ, et al. (2024), who reported that augmented reality technology which integrates sound, text, and images significantly enhances preschool students' motivation for language learning compared to traditional methods. A metric analysis revealed that the overall language abilities of children who interacted with audiovisual media, such as robots, showed a significant improvement compared to those engaged in conventional conversations (Esfandbod et al., 2023). In addition, digital applications that are interactively designed have been shown to support not only learning but also health improvement by increasing engagement, motivation, and comprehension of the delivered content (Fransisca et al., 2023; Caliston, 2025)

Knowledge of various language development interventions can assist both parents and healthcare professionals in optimizing children's growth and development. Although numerous studies have explored technology-based language interventions, existing literature lacks an integrated overview of how different audiovisual tools contribute to children's language outcomes. Therefore, this scoping review aims to identify and categorize the range of audiovisual intervention techniques that have been employed in previous studies to improve language and speech abilities in children.

METHOD

Design

This study utilized a scoping review design to explore and map existing evidence on audiovisual interventions aimed at enhancing language development in children. The approach followed the framework proposed by Arksey and O'Malley (2005), allowing for a broad examination of the literature across various study designs. The review was conducted in accordance with the PRISMA 2020 guidelines.

Search methods

A comprehensive search was conducted across three databases: Scopus, EBSCO, and PubMed. Keywords used included combinations of terms related to children (e.g., "Children," "Preschool," "Toddler"), audiovisual tools (e.g., "Video," "Augmented Reality," "Gamification"), and language development (e.g., "Vocabulary," "Expressive Language"). The search was limited to open-access, full-text, English-language articles published between 2020 and 2025.

Inclusion and exclusion criteria

This scoping review follows the PRISMA Extension for Scoping Reviews (PRISMA-ScR) framework to identify and map existing literature on audiovisual interventions aimed at enhancing children's speech and language development. Articles were selected based on predefined inclusion and exclusion criteria. The inclusion criteria comprised open-access, full-text articles published in English between 2020 and 2025, focusing on audiovisual-based language development interventions in children.

Study selection

A total of 7,354 records were initially identified from three databases: EBSCO (n = 2,782), Scopus (n = 2,557), and PubMed (n = 2,015). After removing 41 duplicate records before screening, 7,313 records remained and were screened based on titles and abstracts. During the screening process, 6,808 records were excluded for not meeting the inclusion criteria. A total of 505 full-text reports were sought for retrieval, but 450 reports could not be retrieved due to access limitations or irrelevance. A total of 42 reports were excluded from the 55 assessed for eligibility, comprising 33 reports that were not open access and 9 that did not focus on audiovisual language interventions. Resulting in 13 studies being included in the final review.

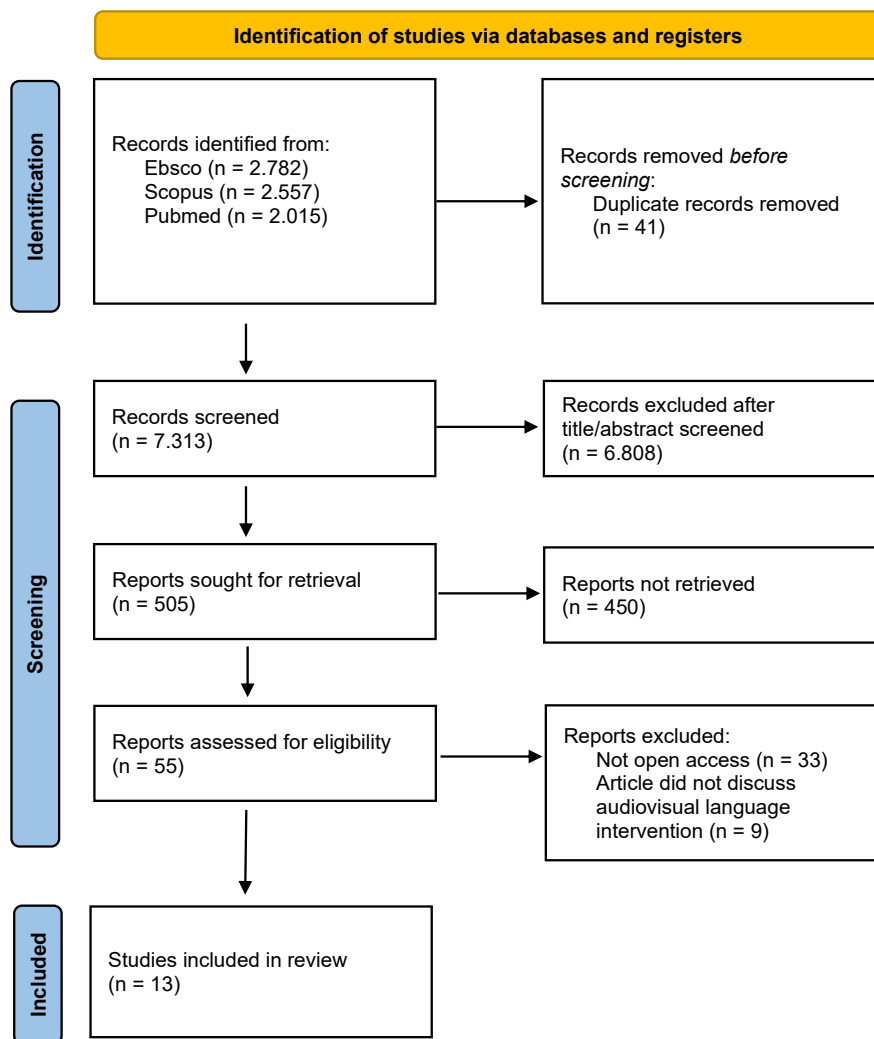


Figure 1. PRIMA Flow Chart

Data extraction

Data from selected studies were extracted using structured clarification, including information on authors, year of publication, Country, research methods, Participants, type of audiovisual intervention, and key findings related to language development.

Data analysis

The selected articles were thoroughly reviewed and analyzed. Subsequently, the interventions were categorized based on similarities and described accordingly.

RESULT

A total of 13 studies were included in this scoping review, encompassing various audiovisual interventions aimed at supporting language development in children. The interventions examined include Socially Assistive Robots (SAR), Augmented Reality (AR), and Mobile-Assisted Language Learning (MALL). The studies were conducted across multiple countries with participants ranging from preschool to elementary school age, and included both typically developing children and those with specific language or cognitive challenges.

The reviewed studies employed diverse research designs, including longitudinal studies, randomized controlled experiments (RCEs), quasi-experiments, clinical trials, and design science research (DSR). The total number of participants across studies was not explicitly stated in all

sources; however, the studies targeted key developmental stages relevant to early childhood language acquisition. Five studies investigated the use of social robots in language learning. These studies found that SAR interventions could enhance various aspects of language development such as vocabulary comprehension, sentence construction, and pronunciation. Moreover, robot-assisted approaches were also associated with increased brain activity in regions linked to language processing, especially in children with developmental language disorders or articulation impairments.

Three studies explored the integration of AR in early language education. The use of AR was associated with improvements in vocabulary acquisition, letter recognition, and learning motivation. AR-based learning environments, which combine real-world interaction with digital enhancements, provided stimulating and engaging contexts for language learning, particularly in early school-aged children. Five studies focused on mobile application-based interventions. MALL approaches showed positive effects on reading, pronunciation, writing, letter knowledge, and bilingual language proficiency. In children with speech or articulation disorders, game-based home speech therapy led to improvements in clarity and vocalization. The summary of the included studies is presented in Table 1.

Table 1.
Summary of Article Analysis

Author(s)	Study Design	Country	Participants	Intervention	Key Findings
(Spitale et al., 2023)	Longitudinal study	Italy	N=20, Children aged 6–11 with Developmental Language Disorder (DLD)	Socially assistive robots	Improved language skills, especially in clitic pronouns and sentence production.
(Berghe et al., 2021)	Randomized Controlled Experiment (RCE)	Netherlands	N=193, 5 year old children	Socially Assistive Robots	Enhanced L2 vocabulary comprehension.
(Hsieh et al., 2023)	Quasi-experiment	Taiwan	N= 29, children aged 10-11	Socially Assistive Robots	The R&T (Robot and Tangible) system improved pronunciation and willingness to communicate.
(Esfandbod et al., 2023)	Quasi-experiment	Iran	N=12, children, mean age 6.4 years	Robot-Assisted Language Learning	Robot-assisted speech therapy (RAST) improved language skills in children with language impairments.
(Alimardani et al., 2023)	Quasi-experiment	Japan	N=41, children, mean age 5.5 years	Robot-Assisted Language Learning	Social robots enhanced brain activity linked to language learning, outperforming animation-only narration.
(Korosidou, 2024)	Quasi-experiment	Greece	N=26, children aged 5.5–6 (Grade 1)	Augmented Reality (AR)	AR improved alphabet and vocabulary mastery and increased learning motivation.
(Lai & Chang, 2021)	Quasi-experiment	Taiwan	N=70, Grade 1 students	Augmented Reality (AR)	AR improved vocabulary test scores and motivation, especially in

Author(s)	Study Design	Country	Participants	Intervention	Key Findings
(Yao et al., 2023)	Design Science Research (DSR)	China	N=25, children aged 6–8	Augmented Reality	attention and relevance. AR showed higher accuracy in language learning tasks.
(Zwitsers et al., 2022)	Randomized controlled non-inferiority trial	Netherlands	N=70, children (age 3;0–3;11) with developmental language disorder (DLD)	MALL (game)	Tablet based vocabulary intervention is equally effective as real-object play
(Wibooliyasarin & Jinowat, 2024)	Experimental quantitative study	Thailand	N=146, grade 2 students (ages 7–8)	MALL (RILCA App)	Improved bilingual (Thai-English) language proficiency.
(Kim et al., 2023)	Prospective Single-Arm Clinical Trial	South Korea	N=13, children aged 4–10 with articulation disorders	MALL (Smart Speech Game)	Home-based game-assisted speech therapy enhanced articulation, voice duration, and clarity.
(Bempt et al., 2021)	Quasi-experiment	Belgium	N=149, children aged 4–5 at cognitive risk for dyslexia	MALL (GraphoGame-Flemish)	Improved letter knowledge and word decoding skills.

DISCUSSION

Robot

This review highlights the effectiveness of social robots in supporting language acquisition among children, a field known as Robot-Assisted Language Learning (RALL) (Alimardani et al., 2023; Berghe et al., 2021; Esfandbod et al., 2023; Spitale et al., 2023). Studies have shown that children engaged in language learning with social robots exhibit significant increases in brain activity, particularly in the theta frequency band across the right hemisphere (Alimardani et al., 2023). Theta band connectivity has been identified as playing a critical role in healthy language development and memory retrieval (Gaudet et al., 2020). These findings align with EEG data demonstrating theta-band synchrony across distributed brain regions, which is significantly associated with improved word learning. Robots have proven to be effective language instructors for children arguably more so than for adults due to their physical presence and socially interactive behaviors that enhance children's engagement and motivation (Lee & Lee, 2022). Additionally, nonverbal communication through robotic gestures facilitates more natural interaction, which ultimately supports more effective language acquisition (Berghe et al., 2021). Further research indicates that the effectiveness of robots and iconic gestures in language learning is moderated by individual child characteristics, such as baseline language proficiency and selective attention skills (Spitale et al., 2023). Therefore, robot-based learning interventions should be designed with consideration of individual differences in order to optimize their impact on children's language development.

Augmented Reality

The reviewed literature also suggests that augmented reality (AR) technologies can significantly enhance children's language abilities (Korosidou, 2024; Lai & Chang, 2021; Najj et al., 2024; Yao et al., 2025). AR integrates real-world environments with virtual elements, allowing for real-time interaction between the two (Demirdağ et al., 2024). These applications display digital objects—such as sounds, graphics, text, shapes, images, and animations—overlaid onto real-world views, typically through a screen. The integration of real-world activities with AR technology during early childhood education has been shown to increase children's attention,

motivation, and conceptual skills, making learning experiences more effective (Aydoğdu, 2021). Furthermore, language acquisition becomes more effective when tailored to the child's developmental stage, readiness, and psychological condition (Liu & Tsai, 2013).

Mobile-Assisted Language Learning (MALL)

Another emerging intervention to support language development in children is Mobile-Assisted Language Learning (MALL). Studies have demonstrated that using mobile applications on tablets, computers, or smartphones can motivate children to engage in learning, enhance their attention during instruction, and improve story comprehension among toddlers aged 2 to 3 years through interactive story-based games (Bemtp et al., 2022). A major advantage of using educational games in therapy is their accessibility to parents, as many apps are free or low-cost, offer flexibility regardless of geographic location, and provide a wide range of educational content suitable for at-home practice (Kim et al., 2023). A variety of mobile learning apps have been developed to support language skills in children, including word games, dictionary lookups, flashcards, multiple choice quizzes, mystery games, alphabet games, handwriting practice, character learning, pronunciation, music, grammar, and language quizzes (Bemtp et al., 2022; Kumar & Goundar, 2022; Williams et al., 2024; Ersanli, 2023). MALL has been found to enhance multiple aspects of language learning, including vocabulary acquisition, sentence structure, grammar comprehension, and productive and receptive skills such as speaking, listening, and writing (Kumar & Goundar, 2022). One example is the Smart Speech game application, which was specifically developed to assist speech therapists in training vocalization and articulation. This structured game includes exercises on oral motor skills, breathing, vocalization, and articulation training (Kim et al., 2023). Thus, MALL is considered a promising tool in improving language function in children.

CONCLUSION

This scoping review demonstrates that audiovisual-based interventions—such as Mobile-Assisted Language Learning (MALL), Augmented Reality (AR), and Robot-Assisted Language Learning (RALL) can significantly contribute to children's language development. These technologies combine visual, auditory, and interactive elements that enhance engagement, comprehension, and motivation, making them suitable for both educational and therapeutic contexts. The integration of audiovisual tools into early language stimulation efforts offers a promising approach to supporting children's communication skills in a developmentally appropriate and accessible manner.

Nurses, particularly in their role as health educators, have an important opportunity to guide parents in utilizing audiovisual interventions at home. By promoting interactive, multimedia-based language activities, nurses can help optimize language environments during critical developmental windows. Future research is needed to evaluate the long-term effectiveness and sustainability of these audiovisual interventions across various developmental stages, including their impact through school age and adolescence. Such evidence will be vital in informing early intervention strategies, nursing practice, and policy development focused on child language and communication health.

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