

The Sound Detection for Hearing Impairment Education: A Qualitative Case Study on Auditory and Non-Verbal Communication in Deaf Children

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Abstract

This research investigates how auditory and non-verbal communication methods affect the language development of a 9-year-old child with severe bilateral hearing loss. Adopting a qualitative, descriptive approach, the study focuses on the influence of techniques such as sound differentiation, articulation training, and non-verbal communication, including sign language, in enhancing the child's linguistic abilities. The participant in this study, NNR, is enrolled in a Special Education Elementary School (SDLB) in Sidoarjo, East Java. Data was gathered through interviews with NNR's teacher and mother, as well as medical records and observation forms. The findings highlight that non-verbal communication methods, particularly sign language and visual aids, are vital for enabling hearing-impaired children to develop language skills. These techniques help bridge the gap caused by limited auditory input, allowing children to develop both expressive and receptive communication abilities. Additionally, the research emphasizes the essential role of parental involvement in reinforcing these skills outside the classroom. The collaboration between the teacher and parents helped establish a consistent learning environment, where NNR was able to apply classroom lessons to real-life situations. Despite these positive outcomes, the study also identifies several challenges in implementing the intervention. The diverse degrees of hearing loss and speech abilities among children require tailored approaches, as standardized methods are often insufficient. Inconsistent home practice, due to time limitations and the parents' understanding of the necessary techniques, further complicated the intervention's effectiveness. Moreover, some children need supplementary medical and therapeutic support, such as speech therapy and hearing treatments, which are not always readily accessible. The research concludes that a comprehensive and individualized approach, incorporating educational methods, family involvement, and medical intervention, is critical to successfully supporting the language development of hearing-impaired children. This study emphasizes the need for a holistic strategy to address the unique needs of these children.

Keywords: Hearing Impairment, Non-Verbal Communication, Sign Language, Auditory Therapy, Parental Support, Educational Strategies

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INTRODUCTION

Children with Special Needs (CWSN) are individuals who possess unique abilities that distinguish them from typically developing children. These children may have differences in physical, mental, or emotional development, but it is important to recognize that these differences come with their own strengths and potential. Despite the challenges they face, CWSN demonstrate resilience and capability, particularly when given the appropriate support and opportunities. These differences affect various aspects of daily life, but education remains one of the areas where these children can significantly benefit from specialized strategies

and resources. As highlighted by Hamida & Harsiwi (2025), the challenges faced by hearing-impaired children in Special Education Elementary Schools (SDLB) underscore the necessity of individualized approaches to support their learning processes. It is crucial that these children receive educational methods tailored to their specific needs to ensure they can achieve their full potential in communication and other cognitive areas.

Statistical data reveals that approximately 140 million children with special needs exist worldwide, accounting for a significant portion of the disabled population. Of this, roughly 2 million out of an estimated 3.5 million disabled individuals in Indonesia alone were identified in the 1980s. The birth of children with special needs is often not anticipated by parents, and historically, children with disabilities were marginalized. In the past, individuals with physical disabilities were often isolated or abandoned, regarded as less capable or unworthy of attention (Ulfah & Ubaidah, 2023). This historical context highlights how society, for many years, failed to recognize the enormous potential of CWSN, including those with hearing impairments, who require additional support in educational settings to enhance their communication and language abilities. This neglect of potential has changed slowly, but more efforts are still required to ensure that these children receive the recognition and care they deserve.

Beyond spoken words, human beings also communicate through non-verbal cues, such as facial expressions, body language, and gestures. According to Bernard Berelson and Gary A. Steiner, communication is the process by which people share information, thoughts, feelings, and skills using symbols like words, numbers, or images. This theory is reinforced in Cashin et al. (2024), which emphasizes that effective communication plays a key role in engagement and the overall quality of educational outcomes. When verbal communication is not possible, non-verbal methods like sign language become crucial in supporting communication for children with hearing impairments. For these children, sign language is not just a substitute for spoken language; it becomes a tool that enables them to interact with their environment and actively participate in educational settings. Sign language provides a structured means of communication that enables hearing-impaired children to convey ideas, understand concepts, and engage socially in ways that would be impossible through spoken language alone.

Language issues are among the primary barriers that many CWSN face. These barriers not only hinder communication but also affect acceptance from peers, parents, and society, often leading to misunderstanding and unfair treatment. In children with hearing impairments, the immediate effect of their disability is the disruption of verbal communication. This affects both their expressive abilities (speaking) and their receptive skills (understanding the speech of others), making it difficult for them to integrate into a hearing society that primarily uses spoken language as its communication tool. These communication difficulties extend into the education system, where hearing-impaired children face challenges in both understanding and producing language. However, despite these barriers, hearing-impaired children possess the inherent capacity to develop speech and language. Recent research indicates that with the right combination of technology, such as hearing aids, and specialized teaching techniques, these children can acquire speech and language skills, often with the help of therapies like Auditory Verbal Therapy (AVT) (Sanchez et al., 2025).

Language acquisition is a fundamental human ability that is acquired progressively throughout childhood. As children grow, they naturally learn to speak and understand language through imitation and listening. However, for children with hearing impairments, acquiring language requires a different approach. Since they cannot rely on auditory input as their primary means of learning, visual aids, and sign language play a vital role in their education. By providing these children with visual and tactile cues, they are able to develop language skills that they might otherwise struggle to acquire. Research conducted by Subihah et al. (2024) highlights the importance of using alternative methods for teaching language to hearing-impaired children, particularly emphasizing how visual learning aids enhance their ability to understand and produce language.

Language is not just an academic skill; it is essential for survival and social integration. It is the medium through which individuals communicate, share ideas, and collaborate with others. As such, language skills are closely tied to a child's ability to thrive in society. For children with hearing impairments, acquiring sign language is critical for linking them to the world around them. Studies have shown that increased exposure to sign language training significantly improves these children's social communication skills, allowing them to better interact with both hearing and non-hearing individuals (Mursita, 2026). Sign language, as a visual communication system, serves not only as a tool for communication but also as a means for children to develop a sense of self and identity. By mastering sign language, hearing-impaired children gain access to

social interactions, educational opportunities, and personal development in ways that verbal language cannot provide alone.

Speech development in hearing-impaired children is intrinsically tied to the degree of their hearing loss. The more severe the hearing impairment, the greater the challenge in producing clear and accurate speech. Articulation, or the ability to speak with clarity, is vital in ensuring that others can understand the message being conveyed. In educational settings, it is essential to employ various techniques to help hearing-impaired children overcome speech and communication challenges. These techniques often include hearing therapy, articulation exercises, and the use of assistive technology. The ability to produce clear speech through proper articulation not only helps in daily communication but also enhances a child's self-esteem and confidence. Recent findings suggest that with appropriate interventions, such as speech therapy and targeted articulation exercises, children with hearing impairments can develop strong, clear speech patterns that significantly improve their ability to communicate with others (Alons et al., 2026).

In conclusion, the development of language skills in hearing-impaired children is a complex process that requires a multi-faceted approach. A combination of auditory and visual techniques, such as the use of hearing aids, sign language, and speech therapy, can significantly enhance their ability to communicate and engage with their surroundings. However, these interventions must be tailored to the specific needs of each child, taking into account the severity of their hearing impairment and their individual learning style. By providing hearing-impaired children with the appropriate support, we can ensure they have the opportunity to develop language skills and fully participate in society.

METHOD

This study employs a qualitative research approach, specifically a descriptive qualitative method, aimed at understanding the dynamics between the presence or absence of sound and its impact on the understanding of non-verbal communication in hearing-impaired children. The choice of a qualitative approach stems from its ability to explore complex, deeply rooted issues in a way that a quantitative approach might not be able to capture. Qualitative research allows for the detailed examination of individual cases, providing a rich and nuanced understanding of how children with hearing impairments interact with their environment and process non-verbal cues. The goal of this study is to obtain a holistic perspective on the challenges faced by hearing-impaired children in learning environments, especially when verbal communication is limited or absent (Yadav & Kushwaha, 2025).

One of the main reasons for selecting a qualitative approach is that it provides the opportunity to investigate the unique and individual experiences of children with hearing impairments. Unlike a broader quantitative study that might generalize findings across a larger population, this research focuses on a single subject, allowing for a detailed exploration of how the absence or presence of sound influences their ability to understand and use non-verbal language. The qualitative approach also emphasizes understanding the perceptions and insights of those directly involved in the learning process, such as educators and parents, whose feedback provides critical context to the child's learning experience. In this way, the study aims to capture the complexities of the child's learning journey, focusing on the integration of sound and non-verbal communication techniques, as well as how these factors are addressed by teachers and caregivers.

The primary research method used in this study is case study research, where the subject is a 9-year-old girl, referred to as NNR, who is currently in the third grade of a Special Education Elementary School (SDLB) in Sidoarjo, East Java. The selection of NNR as the subject allows for an in-depth analysis of her learning process and her interactions with sound and non-verbal cues in a specialized educational setting. NNR's experiences, as well as the strategies employed by her educators, are examined in relation to the influence of auditory stimulation (or the lack thereof) on her learning and communication development.

In addition to focusing on NNR, the study also seeks to understand the perspectives of her educator, identified as S, and her mother, identified as M. Interviews with both the teacher and the parent provide valuable insights into the child's learning process, revealing challenges and effective strategies employed both at school and at home. These interviews help identify key factors that influence the child's communication and language skills. By exploring the contributions of both the teacher and the parent, the study aims to provide a well-rounded understanding of the factors that promote or hinder effective learning for hearing-impaired children. Moreover, NNR's progress is complemented by a medical evaluation, including an ENT (Ear, Nose, and Throat) examination report from Dr. Ramelan Naval Hospital in Surabaya. This document serves as a vital supplement for understanding NNR's hearing condition, which is crucial in assessing her auditory abilities and challenges. The ENT report provides essential data on the child's level of

hearing impairment, which is central to the study's analysis of how hearing loss affects her ability to interpret nonverbal communication.

The research instruments employed in this study include interview guidelines, observation sheets, and other supporting documents that help gather comprehensive data. The interview guidelines were developed to ensure that the main aspects of the child's learning process, especially in relation to the presence or absence of sound, were thoroughly explored. These interviews also addressed the challenges faced by the teacher, the child, and the family in adapting to the child's specific learning needs. The teacher's input on the learning strategies used in the classroom, as well as the mother's observations about home-based communication techniques, provide a comprehensive picture of how NNR is being supported across different learning environments. The study's main objective is to assess the effectiveness of these strategies in promoting non-verbal communication and language development in hearing-impaired children.

Observation sheets, designed as checklists, were used to track specific learning activities that involved sound detection, articulation exercises, and the use of non-verbal communication techniques. These observations were essential for monitoring NNR's responses to various stimuli and for assessing how well she was able to understand and interact with non-verbal cues in her environment. The checklists also provided a structured way to note her progress in terms of sound differentiation, articulation, and understanding non-verbal communication strategies. Additionally, detailed notes were made during the learning sessions to record the use of non-verbal communication strategies by the teacher and NNR's responses. These observational notes were crucial for identifying patterns in the child's behaviour and communication, especially in response to auditory cues or the lack thereof.

The combination of interviews, observations, and supporting documents allowed for a thorough and comprehensive analysis of NNR's learning experiences and challenges. The data gathered through these instruments was analysed to identify key themes related to the effectiveness of non-verbal communication strategies in helping NNR improve her language and communication skills. By focusing on a specific case, the study was able to offer detailed insights into how auditory and non-verbal learning strategies can be integrated and adapted to meet the individual needs of hearing-impaired children.

This research contributes to a better understanding of the role of auditory and non-verbal learning strategies in the education of hearing-impaired children. By examining the intersection of sound differentiation, articulation exercises, and non-verbal communication, the study sheds light on the strategies that can help hearing-impaired children develop language and communication skills despite the challenges they face. Moreover, it highlights the importance of a collaborative approach involving teachers, parents, and healthcare professionals in creating an inclusive and supportive learning environment for these children. The findings also suggest that tailored, individualized approaches are necessary to address the diverse needs of children with varying levels of hearing impairment, ensuring that each child receives the support they need to succeed in their learning and communication development (Basri et al., 2025).

Overall, the qualitative approach of this study allows for a rich and detailed understanding of the factors that influence the learning experiences of hearing-impaired children, providing valuable insights for educators, parents, and other stakeholders involved in the education and support of these children.

RESULTS AND DISCUSSION

The results of the initial assessment of a nine-year-old girl named NNR, who attends a Special Education Elementary School (SDLB) in Sidoarjo, reveal important insights into her medical and developmental condition. NNR was delivered via caesarean section, and her hearing impairment was diagnosed using advanced diagnostic tools such as Auditory Steady-State Response (ASSR), Distortion Product Otoacoustic Emissions (DPOAE), and Auditory Brainstem Response (ABR). These tests revealed that NNR suffers from profound bilateral hearing loss, meaning that she is unable to perceive sounds at the usual frequency ranges without the aid of hearing devices. This diagnosis is significant as it impacts not just her ability to hear but also her overall communication and cognitive development. The ENT (Ear, Nose, and Throat) specialist recommended the use of suitable hearing aids and Auditory Verbal Therapy (AVT) to help stimulate her language development, alongside psychological testing to monitor her cognitive progress (Yadav & Kushwaha, 2025). These early interventions are critical, as they aim to address her communication barriers and facilitate language acquisition, which is essential for her overall growth and educational success.

Before starting any intervention, NNR's ability to detect sound was assessed. The DPOAE test indicated a "Refer" result, meaning that there was no auditory response in both ears, a clear indication of severe

hearing loss. The ASSR results further confirmed this by showing a hearing threshold between 80 – 115 dB HL, placing NNR in the category of profound hearing impairment. Without hearing aids, NNR could not perceive most sounds, which directly hindered her ability to process verbal information. These early findings were crucial in guiding the educational and therapeutic approach for NNR, focusing on visual cues, sign language, and other communication aids to support her (Basri et al., 2025).

The psychological testing conducted on NNR revealed further developmental challenges. Her readiness score for school was relatively low, with a maturation score of 76, indicating that she was not yet ready for formal schooling due to delayed cognitive development. Her motor skills were inconsistent, particularly her fine motor skills, and her understanding of basic numerical concepts and spatial relationships was still unstable. Her memory capacity, short-term recall, and ability to focus were also underdeveloped, which posed significant challenges in a school setting. This psychological assessment not only pointed to the need for a personalized learning plan but also underscored the importance of early intervention to stimulate cognitive and academic growth.

The speech and language challenges NNR faced were multifaceted. Apart from her profound hearing loss, which made it difficult for her to hear instructions and engage with verbal communication, NNR also struggled to follow simple instructions. She was highly dependent on visual cues, such as the teacher's gestures and body language, to understand and interact in class. Her difficulty in responding to sound-based stimuli meant that she could not participate effectively in sound detection activities or recognize the presence or absence of sounds in the classroom, such as during activities involving instruments like drums and tambourines. This inability to hear and detect sound significantly affected her communication skills and learning abilities. She also struggled to follow simple one-step instructions independently, requiring visual or gesture-based support to comprehend verbal tasks.

After beginning the intervention, NNR showed some early improvements. She started to respond to sounds, particularly those with higher intensity or those coming from close proximity. Although her responses were not entirely consistent, they indicated the potential for auditory responses to become more reliable over time with continued therapy. In terms of sound detection during classroom activities, such as using percussion instruments, NNR still struggled to identify whether sounds were present or absent, but her awareness of auditory stimuli improved slightly. Her response to hearing her name, while not yet stable, did appear from time to time, showing that some level of auditory awareness was emerging. This progress, though early, demonstrated that with continued intervention and the use of hearing aids, there was potential for further development in her auditory skills (Sanchez et al., 2025).

Regarding her speech and articulation, NNR exhibited notable progress in her oral-motor skills. These skills are foundational for speech production, and it was encouraging to see that she was able to imitate basic movements, such as opening and closing her mouth in response to visual cues. Her ability to imitate lip movements, such as puckering and stretching, is also important for producing vowel sounds, which are essential in forming words. Additionally, NNR began to show improvement in tongue movements, such as extending her tongue and moving it from side to side. These movements are crucial for articulating certain sounds, and her ability to replicate them indicated that her articulatory muscles were becoming more flexible, which is essential for clearer speech production. Functional oral skills were also evident, as NNR was able to chew and swallow food without any apparent difficulties, which is a good sign for her oral-motor development (Sanchez et al., 2025).

In terms of pronunciation, NNR made impressive strides in producing vowel sounds such as /a/, /i/, /u/, /e/, and /o/, both spontaneously and through imitation. These sounds are foundational for building vocabulary and speech. Her ability to produce these vowels clearly and consistently indicated that she had developed control over her breath, airflow, and the coordination needed for producing speech sounds. Additionally, NNR began to produce diphthongs like "ai," "au," and "oi" through both imitation and structured exercises, showing that she was beginning to combine vowel sounds into more complex speech forms. This ability to produce diphthongs is a sign of further development in articulation and indicates that NNR is progressing in her ability to produce more natural, fluid speech patterns (Sanchez et al., 2025).

On the receptive language side, NNR's ability to understand and respond to verbal communication showed marked improvement. She began to respond to verbal and social cues, such as turning her head when spoken to, smiling in response to a greeting, and focusing her attention when engaged in verbal interactions. These signs suggested that NNR was beginning to understand basic social communication and that her

engagement with verbal exchanges was improving. Though still limited, her receptive language skills were developing, which is crucial for her future language acquisition (Basri et al., 2025).

In terms of expressive language, NNR showed good progress. She was able to produce spontaneous sounds in different social contexts, both during play and in interactions with others. This spontaneous use of sound is a critical component of language development, as it reflects her ability to express herself verbally in different situations. Additionally, NNR was able to engage in more varied social interactions, demonstrating that her expressive language was expanding in line with her developmental milestones.

The success of the intervention was further validated through regular assessments that showed gradual improvement in NNR's auditory and speech abilities. During the sound stimulation phase, she began showing improved phonemic hearing and vocal-motor responses, essential for speech development. Articulation exercises, such as practicing with mirrors, helped NNR position her articulatory organs correctly, further facilitating her speech production. Vocabulary enrichment activities also played a role in strengthening her connection between sounds and words, providing context for their functional use. These activities, combined with consistent auditory stimulation, contributed significantly to her language development (Sanchez et al., 2025).

Parental involvement plays a crucial role in the success of interventions for hearing-impaired children, and it was especially important for the progress of NNR in this study. Research consistently shows that children who receive continuous reinforcement and support from their parents at home tend to demonstrate faster improvements in their learning and development. This was clearly evident in NNR's case. The active participation of her parents ensured that the strategies taught in the classroom were consistently reinforced in the home environment, which is essential for the generalization of the skills learned (Watson et al., 2025). The support NNR received at home created a stable and consistent learning environment, where the progress she made in school could be seamlessly applied to real-world contexts, enhancing her ability to communicate and interact effectively with others.

The teacher's role in this process extended far beyond the classroom. Recognizing the importance of collaboration between school and home, the teacher acted as a mediator to ensure that the intervention was consistent and comprehensive. Regular communication between the teacher and NNR's parents, including updates and practical guidelines for reinforcing what was taught in the classroom, provided the necessary structure and clarity for both the parents and the child. By keeping parents informed about their child's progress and providing them with easy-to-follow strategies for supporting their child's learning, the teacher facilitated a holistic learning approach that spanned both the school and home environments. This collaboration allowed NNR to receive the support she needed in all areas of her life, reinforcing the importance of family involvement in the educational success of children with hearing impairments (Mursita, 2026).

Despite the positive progress, several challenges were encountered in the implementation of the intervention. One of the primary difficulties was the need for individualized approaches to cater to the varying levels of hearing loss and speech abilities among children. Each child's experience with hearing impairment is unique, and a standardized method of intervention often proves to be less effective. This highlights the need for flexible and adaptive strategies that can be tailored to the specific needs of each child. In NNR's case, while the intervention proved to be successful, it required constant adaptation to ensure that it was meeting her evolving needs. Additionally, some children may face challenges in maintaining consistent home practice due to various factors such as limited time or the parents' insufficient understanding of the required techniques. These issues can create gaps in the effectiveness of the intervention, making it difficult for children to consistently apply the learned skills outside of the formal classroom setting (Sanchez et al., 2025).

Another significant challenge encountered was the need for medical and therapeutic interventions, such as hearing and speech therapy. Many hearing-impaired children require additional support from healthcare professionals to address their specific auditory or speech-related issues. However, these services are not always readily available, which can limit the effectiveness of the interventions provided. In NNR's case, although the intervention was beneficial, the absence of continuous access to specialized medical support could have hindered her progress. This underscores the importance of providing comprehensive support for hearing-impaired children, including not only educational strategies but also medical and therapeutic resources. A multidisciplinary approach that combines medical intervention, speech therapy, and educational support is essential for ensuring that children with hearing impairments receive the most effective and comprehensive care possible (Mursita, 2026).

Moreover, these challenges highlight the importance of a collaborative approach that includes not only teachers and parents but also medical professionals, speech therapists, and other specialists who can provide the necessary support for hearing-impaired children. The integration of these various perspectives and expertise is crucial for addressing the full range of needs that hearing impaired children face. For example, speech therapy and auditory interventions, when combined with the educational strategies used in the classroom, can significantly enhance a child's linguistic, cognitive, and social-emotional development. These interventions, however, must be personalized to meet the unique needs of each child, as the severity of hearing loss and the specific challenges associated with it can vary widely (Kayhan & Hakkoymaz, 2025).

In conclusion, while the involvement of parents and teachers is vital for the success of interventions, it is equally important to recognize the challenges that may arise in the implementation process. By adapting the intervention to meet the unique needs of each child, providing consistent support at home, and ensuring access to medical and therapeutic resources, it is possible to improve the educational outcomes for children with hearing impairments. This holistic and personalized approach is essential for helping these children develop the communication and language skills they need to succeed in both academic and social settings.

CONCLUSION

The implementation of a gradual intervention approach that combines auditory stimulation, such as sound differentiation, articulation exercises, and syllable and vocabulary enrichment, has proven to be highly effective in improving the speaking abilities of a 9-year-old child with hearing impairment. This progress has been observed not only within the school environment but also at home. One of the crucial elements in the success of the program has been the active involvement of the parents. Their participation has been instrumental in reinforcing the techniques learned at school, creating a consistent learning environment. Furthermore, the strong collaboration between teachers and parents has played a significant role in ensuring that the child receives continuous support.

In addition to this, the support from the surrounding social environment has been equally important. Friends, extended family, and community members who engage with the child help provide a well-rounded support system. Such collaborative efforts contribute significantly to the child's progress in developing speech and communication skills. The use of simple, concrete media in the program has shown great promise. This approach allows for easy application across different contexts and settings. However, it is important to note that the intervention program must be flexible and tailored to the individual needs of each student. This is essential in accommodating the varying levels of hearing impairment and speech abilities among students. Each child requires personalized adjustments to ensure they receive the most effective intervention based on their unique challenges and potential.

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