Review Article

The Effect of Sign Language on the Language Development of Deaf and Hard of Hearing Children: Systematic Review

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Article info:
Received: 17 Feb 2025
Accepted: 4 May 2025

Citation: Jarollahi F, Fallahnezhad T, Aslibeigi F. The Effect of Sign Language on the Development of Language of Deaf and Hard-of-Hearing Children: Systematic Review. Journal of Modern Rehabilitation. 2025;19(4):?-?

Running title: Sign lang & deaf child lang

Abstract

Objectives: To systematically review and evaluate the evidence regarding the effect of sign language on language development in deaf and hard-of-hearing children.

Method: A comprehensive search of electronic databases, including PubMed/MEDLINE, Web of Science, Scopus, EMBASE, Google Scholar, and ProQuest, from 1995 until April 2024, with no language restrictions, was conducted. The two authors independently assessed the risk of bias using the Newcastle-Ottawa Scale.

Results: Six studies involving 259 participants found that sign language exposure benefits language development in deaf children with hearing aids or cochlear implants. Children exposed to sign language showed similar or even better spoken language skills than those with limited sign language exposure. Encouraging parents to learn sign language can significantly support deaf children's communication and language development.

Conclusion: Deaf children with cochlear implants benefit most from a communication approach tailored to their needs. Early intervention, parental involvement, and a rich language environment (signed or spoken) are key. While sign language exposure shows promise, more

research is needed, especially on its long-term effects and use by hearing parents. PROSPERO registration ID: CRD42023402357.
Keywords: Deaf; Hard of hearing; Language development; Sign language; Systematic review

Introduction

Language development is a fundamental aspect of human communication and cognitive development, serving as the cornerstone for academic achievement, social interaction, and emotional well-being (1,2). The journey of deaf and hard-of-hearing children toward linguistic proficiency often presents unique challenges as they navigate a world predominantly shaped by spoken language. Unfortunately, existing research highlights that one of the main challenges of newborn hearing screening programs is achieving timely language acquisition skills (1).

Historically, two communication approaches have been proposed in intervention programs for language and speech development: (a) the auditory-oral approach, which emphasizes spoken language and peer interaction with hearing individuals, and (b) the visual approach, which utilizes lipreading, sign language, and fosters Deaf culture (2). Given that over 90% of parents of hearing-impaired children are hearing themselves, rehabilitation specialists and parents often opt for spoken language and the auditory-oral approach (3). However, a crucial question arises: how can a child facing hearing difficulties effectively learn their native language from birth, relying solely on an auditory approach? While modern hearing aid technology and cochlear implant advancements have significantly improved spoken language abilities for children with severe and profound hearing loss (1,4), these technologies still fail to bridge the gap in language development before the age of one. Additionally, harmful misconceptions persist in society that hearing aids "cure" hearing loss, leading to delayed intervention during these crucial early months (5).

Research demonstrates that sign languages with established grammatical rules are processed in the brain similarly to spoken languages, indicating their potential to complement each other (6,7). One study showed that children's use of signs and gestures does not negatively impact spoken language acquisition. In fact, learning and using sign language facilitates spoken language acquisition and promotes the development of appropriate thought and reasoning patterns in hearing-impaired children (8). Therefore, the American Academy of Pediatrics has concluded that sign language is a powerful tool for improving communication in young hearing-impaired children (9).

In this context, the significance of providing early exposure to sign language becomes evident as a critical intervention designed to alleviate potential linguistic and developmental disparities experienced by this vulnerable group. Unlike their typically developing peers, deaf and hard-of-hearing children encounter barriers to acquiring language naturally through auditory input. The absence of spoken language access can lead to language acquisition delays and subsequent cognitive, social, and emotional challenges (10,11). Natural sign language input does not harm —and may mitigate— the adverse effects of early auditory deprivation on spoken language development (12) and is essential for deaf children to develop a strong sense of identity and to participate fully in society (13). Early sign language exposure is vital for all children, regardless of their hearing status, as it leads to improved language development, enhanced cognitive development, and stronger social-emotional development (14).

Despite the growing recognition of the importance of early sign language exposure, the field is not without its knowledge gaps. It is essential to determine the most effective timing and intensity of early sign language exposure for different hearing-impaired populations;

comparative studies are needed to assess the effectiveness of early sign language exposure compared to other communication interventions. Limited research has examined the long-term effects of early sign language exposure on hearing-impaired children's language development, and additional research should explore how cultural and linguistic factors influence the effectiveness of early sign language exposure and the development of sign languages tailored to specific communities. The findings of a systematic review suggest that early sign language exposure may positively impact language development, but more research is needed to confirm this and identify the optimal age and intensity of sign language exposure (15).
In response to these limitations, this systematic review aims to comprehensively synthesize the existing literature on sign language and the impact of early exposure on language development in deaf and hard-of-hearing children, assess potential heterogeneity, and identify its possible causes.

Methods

The protocol of the present study was registered in the International Prospective Register of Systematic Reviews (PROSPERO) with identification number CRD42023402357. There were two protocol amendments. First, considering the extended review timeline, we broadened the literature search to include publications up to April 2024. Second, due to insufficient information in the existing literature on the mental health assessment of sign language users, we decided to remove this section from our review.

Search strategy

We employed a systematic and rigorous search strategy to identify relevant studies, ensuring a comprehensive literature review. This search was conducted across multiple electronic databases, including PubMed/MEDLINE, Web of Science, Scopus, EMBASE, and Google Scholar, from 1995 until April 2024, with no language restrictions. Non-English papers were translated using Google Translate. Additionally, grey literature—including ProQuest for relevant theses/dissertations, Scopus and Web of Science for conference papers, and reference lists of primary studies—was searched. Hand-searching was performed for the most recent six months of publications from the Journal of Deaf Studies and Deaf Education and Frontiers in Psychology (Supplementary File 1).

Search terms and keywords

The search strategy was developed using a combination of Medical Subject Headings (MeSH) terms, keywords, expert opinions, and findings from previous primary and secondary studies. The following key terms and their variations were used:

- ("Sign Language" OR "Deaf Sign Language" OR "Sign Communication" OR "Manual Communication")
- ("Language Development" OR "Language Acquisition" OR "Language Skills" OR "Communication Development")
- ("Language test" OR "Speech intelligibility") (corrected spacing)

Inclusion and exclusion criteria

Studies were included in this systematic review if they met the following criteria:

1. **Population**: Studies involving deaf and hard-of-hearing children (infants, children, or adolescents) aged 0–18 years, with varying degrees of hearing loss, including those with

cochlear implants or hearing aids who received early auditory intervention before 5 years of age. Both sexes were included.
2. **Intervention/Exposure**: Studies that investigated early sign language exposure, defined as exposure to sign language before or during early childhood (before 5 years of age), and explored its impact on language development.
3. **Comparison/Control Group**: Studies were included if the comparator was other communication methods, such as auditory-oral, auditory-verbal, or late sign language exposure.
4. **Outcome measures**: Studies that assessed language development outcomes in deaf and hard-of-hearing children, including receptive and expressive language skills, vocabulary, syntax, and literacy.
5. **Study design**: All observational-analytical designs, including cross-sectional, case-control, and prospective and retrospective cohort studies.
6.

Exclusion Criteria

Studies were excluded if they:

1. Did not focus on deaf and hard-of-hearing children,
2. Exclusively involved adults,
3. Lacked a clear definition of sign language exposure,
4. Did not investigate the effect of early sign language exposure on language development.

Study selection

The results were saved in Mendeley (version 1.19.4), and duplicates were removed. One researcher initially screened titles and abstracts based on the predefined inclusion and exclusion criteria. Two reviewers assessed full-text articles of potentially eligible studies independently for final inclusion. Any disagreements between reviewers were resolved through discussion and, if necessary, consultation with a third reviewer.

Data extraction

A standardized data extraction form was developed to collect relevant information from the selected studies. The extracted data included information about the study (authors, year, and design), the participants (age range and hearing loss severity), sign language acquisition methods, usage patterns, the results, and the most crucial language development findings.

Quality assessment

The two authors independently assessed the quality of the included studies using the Newcastle-Ottawa Scale (NOS). Any disagreements between reviewers were resolved through discussion and, if necessary, consultation with a third reviewer.

Data synthesis

The data synthesis process involved a narrative approach, as meta-analysis was not deemed appropriate due to expected heterogeneity among included studies. The results of the studies were combined and grouped by topic to provide a full picture of the effects of sign language on the language development of hearing-impaired children.

Results

Study selection

Our comprehensive database search identified 4,832 potentially relevant articles. After removing duplicates and screening titles/abstracts, we excluded 4,650 articles that did not meet inclusion criteria. The remaining 68 articles underwent full-text review, with six studies ultimately meeting all eligibility criteria for inclusion in this systematic review (Figure 1).

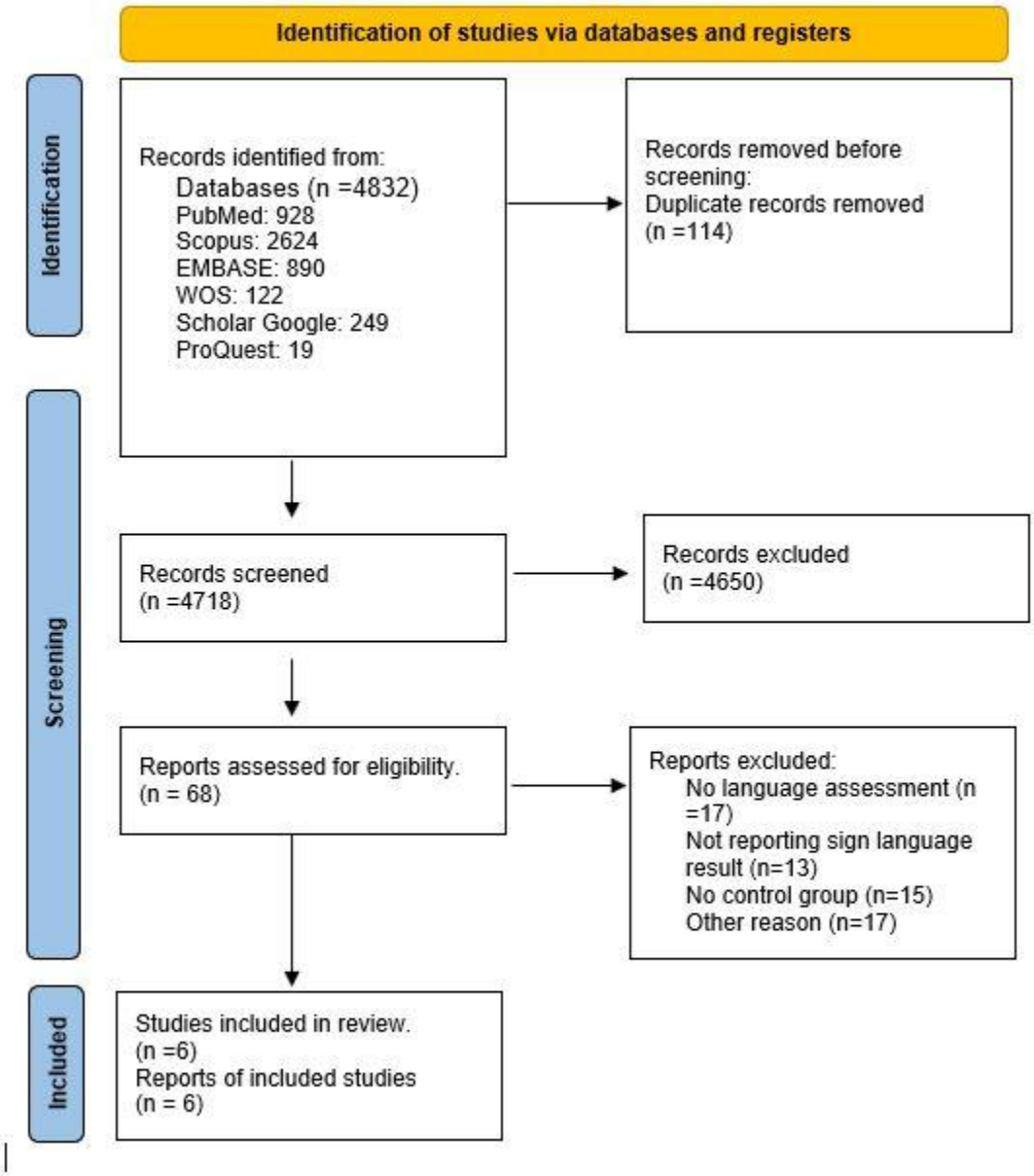

Figure 1: PRISMA flowchart

Characteristics of included studies

The characteristics of the included studies are summarized in Table 1.

Table 1. Study characteristics.

Author, year	Study design	N	Age range (y)	CI age (y)	Intervention groups	Comparison groups	Speech perception measures	Language development measures
Delcenserie et al., 2024	Cross-sectional	40	5-7	2.5-5	Typically developing hearing	Typically developing hearing	-	• Expressive One-Word Picture Vocabulary Test • Échelle de Vocabulaire en Image Peabody • Clinical Evaluation of Language Fundamentals (French-Canadian)
Geers et al., 2017	Retrospective cohort	97	-	3	• Short-term sign • Long-term sign	No sign	• Speech Recognition Index in Quiet • Early Speech Perception Test • Pediatric Speech Intelligibility Test • Lexical Neighborhood Test • PBK Word Lists • HINT-C	Comprehensive Assessment of Spoken Language (Core Composite)
Marshall et al., 2015	Cross-sectional	27	6-11	-	• Native signers (from birth) • Non-native signers (>2 years)	Normal hearing peers	-	• EOWPVT • BSL Narrative Production Test • Language Proficiency Profile-2
Yanbay et al., 2014	Retrospective cohort	42	6-12	<4	Sign+spoken language	• Auditory-oral • Auditory-verbal	-	• PPVT • Preschool Language Scale
Dettman et al., 2012	Retrospective cohort	39	5	-	Bilingual-bicultural	• Aural-oral • Auditory-verbal	-	• PPVT • CNC word test • BKB sentences
Hassanzadeh, 2012	Retrospective cohort	14	8	1.5-5	Deaf parents (signers)	Hearing parents (non-	Persian Auditory Perception Test	Sentence Imitation Test

						signers)		

Study design
All included studies utilized a cohort design, with the exception of one cross-sectional study.

Participant characteristics
The six studies collectively involved 259 deaf and hard-of-hearing children aged 5 to 12 years.

Sample sizes ranged from 14 participants (17) to 97 participants (16).

Language and speech outcomes
This review evaluates the impact of sign language exposure on language development in deaf children with cochlear implants. The included studies measured either spoken language skills or broader language development outcomes.

Studies demonstrating benefits of sign language
Delcenserie et al. administered a combination of assessments, including the French adaptation of the Expressive One-Word Picture Vocabulary Test (EOWPVT) and the Échelle de Vocabulaire en Image Peabody, revealing no significant difference in spoken language abilities between deaf children with CIs exposed to sign language (including brief post-implantation exposure) and typically-hearing children (18). Hassanzadeh employed the Persian Auditory Perception Test for the Hearing Impaired, Speech Intelligibility Rating scale, and Sentence Imitation Test, demonstrating that second-generation deaf children (with native sign language exposure) outperformed those with hearing parents in cochlear implant outcomes (17). These findings indicate that early sign language exposure may facilitate spoken language development post-implantation.

Studies reporting mixed results
Geers et al. evaluated speech perception using the Speech Recognition Index in Quiet and assessed speech intelligibility through adult transcriptions of recorded sentences. Their administration of the Comprehensive Assessment of Spoken Language and Woodcock-Johnson III Tests of Achievement revealed comparatively poorer speech outcomes in children with CIs exposed to sign language (16). However, methodological limitations were noted by Hall et al. (19).

Studies with neutral findings
Yanbay et al. measured language development using post-implant standardized scores for receptive vocabulary, auditory comprehension, and expressive communication. Assessment tools including the Peabody Picture Vocabulary Test (PPVT) and Preschool Language Scale (PLS-4) showed comparable outcomes across three communication approaches: spoken language, sign language, and auditory verbal therapy (20), suggesting comparable effectiveness among these interventions.

Studies demonstrating no adverse effects of sign language exposure
Marshall et al. assessed speech perception and language skills using the EOWPVT and Language Proficiency Profile-2 (LPP-2), supplemented by British Sign Language (BSL) narrative tasks.

While deaf children using sign-supported English or spoken English with BSL showed lower spoken language scores than native signers and hearing peers, they demonstrated superior performance on sign language tasks (21). Dettman et al. examined speech perception (Early Speech Perception test) and receptive vocabulary (PPVT), finding that while auditory-focused programs (Auditory-Verbal (AV) and Auditory-Oral (AO)) showed better outcomes than bimodal-bilingual (BB) approaches, communication mode ceased to be significant when controlling for covariates (22).

Importance of sign language

The weight of evidence suggests that exposure to sign language benefits deaf children with CIs in spoken language measures. Studies by Delcenserie et al. and Hassanzadeh further highlight potential advantages in cochlear implant performance. While Geers et al. reported associations with poorer speech outcomes, limitations in their design require consideration. Research by Marshall et al. and Dettman et al. demonstrates no adverse effects of sign language exposure on spoken language development. Notably, Marshall et al. found that deaf children who preferred sign language excelled in sign language tasks. Yanbay et al.'s study adds another layer by showing no significant differences in language development across various communication programs, suggesting that all approaches can be effective.

Overall, these studies underscore the importance of sign language for deaf children. Sign language is a natural and effective communication tool, especially for Deaf children, that supports language development, even with non-native exposure from hearing parents, as suggested by Hassanzadeh. These results challenge policies that discourage sign language use with deaf children. Encouraging and supporting parents in learning sign language and providing resources for access to native speakers can significantly benefit deaf children.

The evidence indicates that exposure to sign language is beneficial for deaf children with cochlear implants (CIs) in terms of spoken language outcomes. Research by Delcenserie et al. and Hassanzadeh highlights potential advantages regarding cochlear implant performance. Although Geers et al. reported correlations with poorer speech outcomes, the design limitations of their study warrant careful consideration. Studies conducted by Marshall et al. and Dettman et al. reveal no adverse effects of sign language exposure on the development of spoken language. Notably, Marshall et al. found that deaf children who preferred sign language excelled in sign language tasks. Furthermore, Yanbay et al.'s research indicates no significant differences in language development across various communication programs, suggesting that all approaches can be effective.

Overall, these studies emphasize the importance of sign language for deaf children. It serves as a natural and effective communication tool that fosters language development, even when exposure comes from hearing parents who are not native signers, as highlighted by Hassanzadeh. These findings challenge policies that discourage the use of sign language with deaf children. Supporting and encouraging parents to learn sign language, along with providing access to resources and native speakers, can greatly enhance the development of deaf children.

Quality assessment

The methodological quality of included studies was assessed using the Newcastle-Ottawa Scale (NOS). This tool evaluates three key domains: (1) selection of study groups, (2) comparability of groups, and (3) ascertainment of exposure (for cohort studies) or outcomes (for cross-sectional

studies). All six included studies achieved high-quality ratings based on their NOS scores (Table 2).

Table 2 (a). Quality assessment of cohort study using Newcastle-Ottawa Scale.

Author, year	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Outcome of interest was not present at start	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Was follow-up long enough for outcomes to occur	Adequacy of follow-up of cohorts	Total score	Overall rating
Geers et al., 2017 [15]	1	1	1	1	1	1	1	1	8	High quality
Yanbay et al., 2014 [19]	1	1	1	1	1	1	1	1	8	High quality
Dettman et al., 2012 [21]	1	1	1	1	1	1	1	1	8	High quality
Hassanzadeh, 2012 [16]	1	1	1	1	0	1	1	1	7	moderate-quality

Table 2 (b). Quality assessment of cross-sectional study using the Newcastle-Ottawa Scale

Author, year	Representativeness	Sample size	Non-respondents	Exposure ascertainment	Comparability	Outcome assessment	Statistical test	Total score	Rating
Delcenserie et al., 2024	1	1	1	2	1	2	1	9	High quality
Marshall et al., 2015	1	1	0	2	1	2	1	8	High quality

Discussion

This systematic review examined the effects of sign language exposure on language development in deaf and hard-of-hearing children through analysis of six studies encompassing 259 participants. The findings demonstrate that outcomes are mediated by multiple interacting factors, including the nature and extent of sign language exposure (particularly differences between native versus non-native exposure and duration of use), child-specific characteristics such as age at implantation and degree of hearing loss, the structure and quality of educational interventions, and the level of family engagement in the language learning process. These results corroborate existing literature documenting variable impacts of sign language exposure while contrasting with studies that report more uniform outcomes. The observed variability across studies likely stems from fundamental differences in research methodologies, including heterogeneity in study designs and participant populations, inconsistent application of assessment tools, and inherent challenges in quantifying both sign language exposure and its developmental consequences.

Communication approaches for children with cochlear implants

Cochlear implants (CIs) offer an encouraging technology for deaf children, providing access to sound and supporting the potential development of spoken language skills. However, determining the most effective communication approach to optimize these benefits remains an active area of research and debate. This discussion examines key findings and controversies regarding communication strategies for deaf children using CIs.

Early intervention is paramount

Research consistently demonstrates the critical importance of early intervention for language development in deaf children, irrespective of the chosen communication modality (22,23). Timing plays a crucial role, as delayed intervention may compromise language acquisition outcomes in both spoken and signed language development.

Sign language exposure: benefits and considerations

Research demonstrates that sign language exposure, particularly from deaf parents, correlates with improved language outcomes in deaf children with CIs (17,24–27). Key benefits of early sign language exposure include establishing a complete language system prior to implantation that may facilitate subsequent spoken language development (18), enhancing visual-spatial processing to complement auditory input from CIs (17), and enabling deaf parents to provide linguistically rich input through natural signing (17,27). The quality of exposure proves critical, with studies indicating native-signing deaf parents create more optimal language environments than hearing parents acquiring sign language (27). While these findings are promising, additional research is needed to examine long-term outcomes for children with hearing parents (16).

Current evidence suggests sign language exposure does not impede spoken language development in children with CIs. Neuroimaging studies reveal that increased visual cortex activation from signing shows no negative association with speech outcomes (28–31), supporting the principle that early language access, regardless of modality, is paramount. Bilingual approaches combining sign and spoken language demonstrate no detrimental effects on oral language acquisition (32), and hearing parents can achieve sign language proficiency with proper support (33,34). Emerging evidence indicates sign language may positively influence spoken language development through cross-modal transfer or by preventing early language deprivation

(35–43). However, further investigation is warranted regarding hearing parents' sign language use with infants and toddlers.

Communication Approaches: Beyond a Single Best Method

Studies indicate multiple communication approaches—including auditory-verbal (AV), auditory-oral (AO), and bimodal-bilingual (BB) methods—can yield successful outcomes with CIs (22). While AV and AO approaches focusing exclusively on spoken language show efficacy, research suggests implantation age may be a stronger predictor of outcomes than communication method selection (22). The BB approach, integrating sign language with spoken input, shows promise though requires more extensive study, particularly for children under four years (20).

The evidence underscores that optimal communication approaches should be individualized, considering each child's unique needs, family dynamics, and cultural context (20,22). Regardless of methodology, ensuring a linguistically rich environment—whether signed, spoken, or combined—remains essential for maximizing developmental outcomes (21).

Conclusion

The evidence confirms there is no universal "best" communication approach for deaf and hard-of-hearing children with cochlear implants. Three key factors emerge as critical for optimal outcomes: early intervention, active parental involvement, and access to a linguistically rich environment. While existing research demonstrates clear benefits of sign language exposure, further investigation is particularly needed regarding long-term outcomes and implementation by hearing parents. Successful outcomes ultimately depend on a collaborative, individualized approach that carefully considers the child's unique needs, family preferences, cultural background, and current evidence. This approach requires coordinated efforts among parents, audiologists, speech-language pathologists, and educators to develop personalized communication plans that support both language development and overall well-being.

Acknowledgments:

The authors have no acknowledgments to declare.

Authors' contributions:

T.F.: Conceptualization, study design, literature search, data extraction, manuscript drafting
F.J.: Risk of bias assessment, critical manuscript review
F.A.: Data interpretation, critical analysis
All authors reviewed and approved the final manuscript.

Conflict of interest:

The authors declare no conflicts of interest.

Funding:

This research did not receive any external funding.

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Supplementary 1:

Search strategy

PubMed

((Language[all] AND sign[all]) OR "Sign language"[all] OR (Communication[all] AND manual[all]) OR "Manual communication"[all] OR "American sign language"[all] OR "ASL"[all] OR "Communication mode"[all] OR "Manual communication*"[all] OR (Communication*[all] AND Manual[all]) OR "Oral-aural communication"[all] OR "Total communication"[all] OR "Total Communication Method*"[all] OR ("Communication Method"[all] AND Total[all]) OR (Method*[all] AND "Total Communication"[all]) OR "Auditory verbal training"[all] OR "Auditory verbal"[all] OR "Bilingual-Bicultural Education"[all] OR "Cued speech"[all] OR (Cued[all] AND speech[all]) OR "Speech reading"[all] OR ("Disabled Education"[all] AND Hearing[all]) OR "Education of Persons with Hearing Impairments"[all]) AND ("Language test*"[all] OR "Vocabulary test*"[all] OR "Language comprehension test"[all] OR "Language acquisition"[all] OR (Acquisition[all] AND language[all]) OR ("articulation test"[all] AND speech[all]) OR "Speech articulation test"[all] OR (Test[all] AND articulation[all]) OR (Intelligibility[all] AND speech[all]) OR "speech intelligibility"[all] OR (perception[all] AND speech[all]) OR "spoken language"[all]) AND 1995/01/01:2022/12/30[dp]

CENTRAL

((Language:ti AND sign:ti,ab) OR 'Sign language':ti OR (Communication:ti AND manual:ti,ab) OR 'Manual communication':ti OR 'American sign language':ti OR 'ASL':ti OR 'Communication mode':ti OR 'Manual communication*':ti OR (Communication*:ti AND Manual:ti) OR 'Oral-aural communication':ti OR 'Total communication':ti OR 'Total Communication Method*':ti OR ('Communication Method':ti AND Total:ti) OR (Method*:ti AND 'Total Communication':ti) OR 'Auditory verbal training':ti OR 'Auditory verbal':ti OR 'Bilingual-Bicultural Education':ti OR 'Cued speech':ti OR (Cued:ti AND speech:ti) OR 'Speech reading':ti OR ('Disabled Education':ti AND Hearing:ti) OR 'Education of Persons with Hearing Impairments':ti) AND ('Language test*':ti OR 'Vocabulary test*':ti OR 'Language comprehension test':ti OR 'Language acquisition':ti OR (Acquisition:ti AND language:ti) OR ('articulation test':ti AND speech:ti) OR 'Speech articulation test':ti OR (Test:ti AND articulation:ti) OR (Intelligibility:ti AND speech:ti) OR 'speech intelligibility':ti OR (perception:ti AND speech:ti) OR 'spoken language':ti)

EMBASE

((Language:ti,ab AND sign:ti,ab) OR 'Sign language' OR (Communication:ti,ab AND manual:ti,ab) OR 'Manual communication' OR 'American sign language' OR 'ASL' OR 'Communication mode' OR 'Manual communication*' OR (Communication* AND Manual) OR 'Oral-aural communication' OR 'Total communication' OR 'Total Communication Method*' OR ('Communication Method' AND Total) OR (Method* AND 'Total Communication') OR 'Auditory verbal training' OR 'Auditory verbal' OR 'Bilingual-Bicultural Education' OR 'Cued speech' OR (Cued AND speech) OR 'Speech reading' OR ('Disabled Education' AND Hearing) OR 'Education of Persons with Hearing Impairments') AND ('Language test*' OR 'Vocabulary test*' OR 'Language comprehension test' OR 'Language acquisition' OR (Acquisition AND language) OR ('articulation test' AND speech) OR 'Speech articulation test' OR (Test AND articulation) OR (Intelligibility AND speech) OR 'speech intelligibility':ti,ab OR (perception AND speech) OR 'spoken language':ti,ab) AND [1995-2022]/py

Proquest

((AB,TI(Language) AND AB,TI(sign)) OR AB,TI("Sign language") OR (AB,TI(Communication) AND AB,TI(manual)) OR AB,TI("Manual communication")OR AB,TI("American sign language") OR AB,TI("ASL") OR AB,TI("Communication mode") OR AB,TI("Manual communication*") OR (AB,TI(Communication*) AND AB,TI(Manual)) OR AB,TI("Oral-aural communication") OR AB,TI("Total communication") OR AB,TI("Total Communication Method*") OR (AB,TI("Communication Method") AND AB,TI(Total)) OR (AB,TI(Method*) AND AB,TI("Total Communication")) OR AB,TI("Auditory verbal training") OR AB,TI("Auditory verbal") OR AB,TI("Bilingual-Bicultural Education") OR AB,TI("Cued speech") OR (ALL (Cued) AND AB,TI(speech)) OR AB,TI("Speech reading") OR (AB,TI("Disabled Education") AND AB,TI(Hearing)) OR AB,TI("Education of Persons with Hearing Impairments")) AND (AB,TI("Language test*") OR AB,TI("Vocabulary test*") OR AB,TI("Language comprehension test") OR AB,TI("Language acquisition") OR (AB,TI(Acquisition) AND AB,TI(language)) OR (AB,TI("articulation test") AND AB,TI(speech)) OR AB,TI("Speech articulation test") OR (AB,TI(Test) AND AB,TI(articulation)) OR (AB,TI(Intelligibility) AND AB,TI(speech)) OR AB,TI("speech intelligibility") OR (AB,TI(perception) AND AB,TI(speech)) OR AB,TI("spoken language")) **AND** YR(19950101-20221230)

Scopus

((TITLE-ABS (Language) AND TITLE-ABS (sign)) OR TITLE-ABS ("Sign language") OR (TITLE-ABS (Communication) AND TITLE-ABS (manual)) OR TITLE-ABS ("Manual communication")OR TITLE-ABS ("American sign language") OR TITLE-ABS ("ASL") OR TITLE-ABS ("Communication mode") OR TITLE-ABS ("Manual communication*") OR (TITLE-ABS (Communication*) AND TITLE-ABS (Manual)) OR TITLE-ABS ("Oral-aural communication") OR TITLE-ABS ("Total communication") OR TITLE-ABS ("Total Communication Method*") OR (TITLE-ABS ("Communication Method") AND TITLE-ABS (Total)) OR (TITLE-ABS (Method*) AND TITLE-ABS ("Total Communication")) OR TITLE-ABS ("Auditory verbal training") OR TITLE-ABS ("Auditory verbal") OR TITLE-ABS ("Bilingual-Bicultural Education") OR TITLE-ABS ("Cued speech") OR (ALL (Cued) AND TITLE-ABS (speech)) OR TITLE-ABS ("Speech reading") OR (TITLE-ABS ("Disabled Education") AND TITLE-ABS (Hearing)) OR TITLE-ABS ("Education of Persons with Hearing Impairments")) AND (TITLE-ABS ("Language test*") OR TITLE-ABS ("Vocabulary test*") OR TITLE-ABS ("Language comprehension test") OR TITLE-ABS ("Language acquisition") OR (TITLE-ABS (Acquisition) AND TITLE-ABS (language)) OR (TITLE-ABS ("articulation test") AND TITLE-ABS (speech)) OR TITLE-ABS ("Speech articulation test") OR (TITLE-ABS (Test) AND TITLE-ABS (articulation)) OR (TITLE-ABS (Intelligibility) AND TITLE-ABS (speech)) OR TITLE-ABS ("speech intelligibility") OR (TITLE-ABS (perception) AND TITLE-ABS (speech)) OR TITLE-ABS ("spoken language")) AND PUBYEAR > 1994 AND PUBYEAR < 2023

WOS

((TI= (Language) AND TI = (sign)) OR TI = ("Sign language") OR (TI = (Communication) AND TI = (manual)) OR TI = ("Manual communication") OR TI = ("American sign language") OR TI = ("ASL") OR TI = ("Communication mode") OR TI = ("Manual communication*") OR (TI = (Communication*) AND TI = (Manual)) OR TI = ("Oral-aural communication") OR TI = ("Total communication") OR TI = ("Total Communication Method*") OR (TI = ("Communication Method") AND TI = (Total)) OR (TI = (Method*) AND TI = ("Total Communication")) OR TI = ("Auditory verbal training") OR TI = ("Auditory verbal") OR TI = ("Bilingual-Bicultural Education") OR TI = ("Cued speech") OR (TI = (Cued) AND TI = (speech)) OR TI = ("Speech reading") OR (TI = ("Disabled Education") AND TI = (Hearing)) OR TI = ("Education of Persons with Hearing Impairments")) AND (TI = ("Language test*") OR TI = ("Vocabulary test*") OR TI = ("Language comprehension test") OR TI = ("Language acquisition") OR (TI = (Acquisition) AND TI = (language)) OR (TI = ("articulation test") AND TI = (speech)) OR TI = ("Speech articulation test") OR (TI = (Test) AND TI = (articulation)) OR (TI = (Intelligibility) AND TI = (speech)) OR TI = ("speech intelligibility") OR (TI = (perception) AND TI = (speech)) OR TI = ("spoken language")) AND PY=(1995-2022)