Article

Communication, Language, and Modality in the Education of Deaf Students

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Abstract: In the history of deaf education, questions attending communication, language, and modality have generated much discussion, and even heated debate. This should not be surprising as these questions touch on a fundamental issue that is central to policy and practice in the field—how to provide early, ready, and meaningful linguistic access. While one point of agreement is that such access is vital for age-appropriate language and literacy development, there is less consensus on how this access should be realized. This focus has heightened consequences and significance in the current context in which auditory access to spoken language is possible for the majority of deaf children. With a goal of reframing the conversation, the focus of this article will be on making the critical distinctions between language and modality that can inform understandings as to how access can be best achieved for an increasingly diverse population of deaf children and their families.

Keywords: deaf; spoken language; signed language; modality

1. Introduction

Issues of communication, language, and modality have been central to the field of deaf education over time, generating much discussion, deliberation, and often debate. These considerations have been at the core of much disagreement in the field, particularly as they pertain to the roles that spoken and/or signed language should play in the education of deaf students [1–4]. Despite the ongoing tensions these issues engender, there is a fundamental common concern across perspectives—how to effectively provide early, meaningful linguistic access for deaf children.

The premise underlying this concern is that for any child to develop language, the child must be afforded an environment in which there is exposure in quality and quantity to an accessible language while engaged in meaningful activity with others who are capable users of the language [5,6]. While access to the spoken language of the home can be presumed for children with typical hearing, this is not the case for children born with hearing loss, and within the field of deaf education there is not always consensus among stakeholders as to how this access should best be realized.

In this article we will discuss access for deaf children in the current context in which early identification via newborn hearing screening and advances in hearing technologies (including implantable devices) have dramatically impacted the extent to which and when deaf children have meaningful access to spoken language (i.e., linguistic input that is comprehensible and allows for contingently responsive interactions). We will also consider the ramifications of this shift for parents and caregivers making communication choices for their deaf children, how they can be better informed in making these choices, and the educational implications of the access choices they make.

2. Access in Changing Contexts

For the better part of the 20th century, access to spoken language was challenging for most deaf children identified with severe to profound hearing loss. Available hearing
technologies did not provide ready, meaningful access to spoken language, which meant that many of these deaf children did not acquire age-appropriate language, leading to depressed academic outcomes especially in reading and writing. To address these concerns, various avenues were proposed to support access to spoken language for the purposes of acquiring it. These included speechreading, fingerspelling, signing, and Cued Speech, which is a communication system designed to provide complete visual access to the phonology of a language through the simultaneous coordination of three elements: mouth movements associated with speaking the language, eight manual handshapes to represent consonants, and four placements near the mouth to denote vowels. [7]. The motivation across strategies was to support the auditory (spoken) input with visual cues to allow for enhanced access to the target spoken language. The primary educational manifestation of this philosophy was Total Communication (TC). Despite decades of debate and a decided lack of research (for a discussion see [8]), it is noteworthy that the definition of TC has not fundamentally changed over its more than 40-year history, with it being “consistently described as an approach, not a method, incorporating the use of multiple modalities for providing access to language, including all forms of manual communication and the use of hearing technologies” [7] (p. 37). It is worth noting, however, that during most of this era, hearing technologies were limited in the extent to which they provided access to spoken language, resulting in much more access weight placed on the visual stream.

In contrast to spoken languages, natural signed languages (e.g., American Sign Language) are fully accessible to deaf children. As such, a case was made in the late 1980s and 1990s that deaf children would be best served if they were first provided access to a visual language that was readily accessible without the use of amplification or specific interventions if appropriate language learning conditions were in place. The educational argument was that “this access would provide the basis for the development of age-appropriate language and cognition and support the transition to text-based literacy in the majority spoken language” [9] (p. 176). This approach was realized pedagogically in sign bilingual programs that were implemented globally (e.g., Australia, Canada, England, New Zealand, South Africa, Sweden, and the United States).

While in theory it was anticipated that significant numbers of deaf children would acquire a natural signed language as their first language (L1), in practice this was most often not the case, with few deaf children developing age-appropriate abilities in signed language [10,11]. This seems to be a consequence of the reality that over 95% of deaf children are born to hearing parents [12,13] who do not sign and are often challenged to acquire the language in order to use it meaningfully with their children. In essence, one acquisition challenge was traded for another. While the target language was fully accessible visually, most hearing parents were not capable users and lacked the fluency to serve as viable models and interlocuters from birth.

An ongoing challenge in the field has been to find ways to support the early acquisition of a natural signed language for these deaf children, and for this to then serve as a path to bilingualism and literacy development (see [14] for discussion). In making their argument for the benefits of the early use of a natural signed language for access, Hall et al. [4] also acknowledged that practical challenges remain, primarily associated with the quality and quantity of input and family desires and beliefs.

In the current context, access has been shaped by the dramatic developments and advances that have been made in hearing technologies. In conjunction with early identification of hearing loss via newborn screening, usually in the first six months of life, most deaf infants now have meaningful access to language via these technologies [15]. These technologies include digital hearing aids, bone anchored hearing aids, and implantable devices, including cochlear implants, which are now most often performed bilaterally and usually by one year of age [16]. Candidacy requirements for cochlear implantation have also been expanded to include children with greater residual hearing and even those with single-sided deafness [17], meaning that the cohort of children with cochlear implants is only growing. However, it is also important to recognize that not all children who
could benefit from hearing technologies have access to them. This is especially the case in developing countries, and even in high income countries, there may be considerable variation in access to services [15]. This is a consequence of issues such as high costs and shortage of services with multiple factors such as socioeconomic status, insurance status, parental educational level, and travel distance being associated with delayed access [18].

Acknowledging this caveat, it remains the case that there are increased opportunities for developing spoken language at an age-appropriate level for deaf children who have access to hearing technologies and the necessary associated support services. Indeed, there is a growing body of research evidence to support this claim [19–23]. The reality in the current climate is that meaningful access to spoken language via technology is possible for many deaf children for the first time in the history of the field.

3. Families, Language Acquisition, and Access

Upon learning that their child has been identified with a hearing loss, parents of deaf children are faced with many decisions at a time when they are most often still struggling to come to terms with the news that their child is deaf [24,25]. As one parent remarked, “I cannot remember anything they said after the word ‘deaf’. I had to call the office later and ask for all the details over again.” [26].

While this can be an overwhelming period, parents do not have the luxury of time to make decisions. They need to make immediate choices related to hearing technologies, how they will provide access to language, and whether they will use spoken and/or signed language. These choices have direct consequences for how their child will access and develop language, and whether this will ultimately bring about age-appropriate language and literacy outcomes.

It is also worth remembering that this decision making happens in the context of each family’s lived reality. As noted above, more than 95% of deaf children have hearing parents who use a spoken language in the home. Additionally, it should not be assumed that the 5% of parents who have a hearing loss are all using a signed language. These deaf parents might also communicate primarily via spoken language or some combination of a spoken and signed language. To further complicate the language acquisition context, many deaf children come from homes where the spoken language of the home is not the majority language of the community. For example, in a recent investigation of literacy outcomes, more than 40% of the deaf students were from multilingual contexts representing 18 different home languages [27,28]. Furthermore, as Crowe and Guiberson [29] point out, deaf multilingual students could be bilingual, trilingual, quadrilingual, mono-modal or bimodal, or could require additional language for access to education.

Harkening back to what is essential for language acquisition to occur as naturally as possible, two factors need to be considered—that the language is accessible and that the parents can use that language capably. Only if both conditions are met can the parents and their child engage in the contingently responsive communicative interactions that are the foundation for language, cognitive, and social and emotional development. This raises questions as to how parents make decisions related to access and language that meet these conditions, afford the optimal fit for their family, and best meet the needs of their individual deaf child.

In supporting parents in the process of making these decisions, emphasis is placed on the concept of informed choice. Informed choice is viewed as a principle guiding practice in which families gain the necessary knowledge, information, and experiences to make fully informed decisions (i.e., Principle 3 of the Family-Centered Early Intervention Guidelines [FCEI-DHH], [30]). Aspects of this informed decision-making process include: (1) sharing information and experiences from a variety of sources that are comprehensive, meaningful, relevant, and unbiased; (2) being mindful that “informed choice” is not synonymous with information that is neutral or functionally descriptive, but draws attention to the various risks, benefits, and uncertainties related to particular options; (3) informing families about expectations for them that are inherent in implementing various approaches, as well as
potential benefits and challenges; (4) assisting families to identify and successfully rely on their abilities and capabilities; and (5) supporting families to reach decisions in ways that reflect their individual strengths, resources, needs, and experiences (p. 434).

4. Access and Informed Choice

As with many well-intentioned principles, it can be challenging to realize them in practice. On the face of it, informed choice seems eminently sensible and even-handed as an approach. However, no matter how well-intentioned presenting “unbiased knowledge” might seem to be, parents need to make sense of this information and then align it with their own context, capabilities, and resources as they make decisions that might actually work for their child and their family. Informed choice can quickly become informed confusion as the parents often feel overwhelmed and perplexed by the options presented to them. They often have questions about what is meant by signed language, whether you speak while you use signed language, and how signed language is compatible with the use of hearing technologies. For the vast majority of parents, this is the first time that they need to think about these issues, and it should not be surprising that they feel ill-prepared to make decisions. Even though they may be new to these access issues in deaf education, they are the experts on their own family context in terms of the language(s) they use in the home, the make-up of the family unit, and what works in terms of making communication and interaction happen in their particular situation.

Making a choice about providing meaningful access to language is a fundamental aspect of the decision-making process and is often at the core of the confusion parents describe. Much of this confusion rests on the extent to which access can be realized via audition alone (i.e., relying primarily on listening and the use of hearing technologies), or some combination of audition and visual supports (i.e., signs to support language access). To assist parents in thinking about the range of access options, various models have been developed.

One example is the A-to-V Communication Continuum presented in Table 1 below. This continuum is “a tool that can be used to describe a child’s ability to understand spoken language through listening and his/her needs for accompanying visual supports. The “A” stands for Auditory, meaning spoken language. The “V” stands for Visual. Visual supports can include use of American Sign Language (ASL), or signs used to support spoken language, in addition to visual supports such as Cued Speech, speech reading (lip reading), pictures, objects, written words, gestures, and facial expressions” [31].

<table>
<thead>
<tr>
<th>Auditory</th>
<th>AV</th>
<th>AV</th>
<th>Va</th>
<th>Visual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does not require visual support for clarification</td>
<td>Mostly Auditory: Needs some visual support for clarification</td>
<td>Equal need for auditory and visual supports</td>
<td>Mostly Visual: Understands some spoken word/phrases</td>
<td>Visual: Does not understand spoken words/phrases</td>
</tr>
</tbody>
</table>


In a similar vein, Nussbaum et al. [32] describe two continuums—“a receptive continuum for how a child accesses language (ranging from visual only to auditory only) and an expressive continuum for how a child expresses language (ranging from sign only to oral only)” (p. 313). As illustrated in Table 2, receptively, students might be primarily visual learners and develop auditory skills to supplement their language and communication, while others may be primarily auditory learners who use sign as the supplement, and yet some might move equally between accessing both visual and spoken language. On the expressive continuum, some students use sign with some spoken language, others might
express themselves primarily through spoken language with some sign, and some are able to express themselves equally in sign or spoken communication.

Table 2. Communication Continuum for Individuals who are Deaf/Hard of Hearing.

<table>
<thead>
<tr>
<th>Fully Visual</th>
<th>Mostly Visual</th>
<th>Equal Visual/Auditory</th>
<th>Mostly Auditory</th>
<th>Fully Auditory</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>VA</td>
<td>VA</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

Note. Created by Resource Materials and Technology Center for the Deaf/Hard of Hearing [31], adapted from Nussbaum et al. [33].

What is problematic in both models is the conflation of language and modality, and as such, we would suggest that they engender confusion for parents when they are in the process of making informed choices about access. In the interest of providing more clarity, it would be useful to focus on the difference between language and modality. Language is defined as a “system of conventional spoken, manual (signed), or written symbols by means of which human beings, as members of a social group and participants in its culture express themselves” [34]. Examples in North America include English, ASL, French, and Langue des Signes Québécoise (LSQ). Given that it is only more recently that natural signed languages have been recognized as bonafide languages [35], it is important to emphasize that signed languages are equal in status to spoken languages, but distinct from them with their own grammar and syntax. It is also the case that they are not spoken (i.e., it is not possible to combine spoken English and ASL).

In contrast to language, modality simply refers to the means or channel by which any language is conveyed and accessed (e.g., speech, sign, print, etc.). For example, while English can be conveyed via both speech and print, ASL is conveyed via signs. Sign, like speech, is a modality, not a language. Being clear as to whether we are referring to language or modality is key to providing clarity in presenting access options to families.

In the models above, a continuum for how a child accesses language is presented from auditory to visual. Both are built on an underlying premise that access to spoken language can buttressed by visual supports including ASL. However, this does not make sense. ASL is a language distinct from English and is not used in conjunction with spoken language. Therefore, in what way can ASL provide visual support for developing spoken English? To put it another way, conceptualizing what it means to be a mostly auditory or a mostly visual communicator becomes problematic when the target language has not been identified. Which language is being accessed—ASL, English, or both? Is the goal to acquire one language or to become bilingual? Does being a visual communicator imply the use of ASL? What are the implications for the use of hearing technologies when using ASL as there is no spoken language accompanying the signs? Given these persistent questions, it would be important to reframe the access options in the process of providing parents with informed choice.

5. Reframing Access Options

Age-appropriate acquisition of a language for communication is a concern for the parent of every deaf child. Fundamental to this decision is determining how to make language(s) meaningfully accessible (i.e., via which modalities), bearing in mind the language acquisition conditions of the family and the home. As noted at the outset of this paper, this focus on access often coalesces around questions of the role of signed communication,
particularly as it relates to whether and how signs can support the development of spoken language. If the goal is to promote a “process wherein families gain the necessary knowledge, information, and experiences to make fully informed decisions” [30] (p. 434), it would behoove professionals to think about presenting options in a way that is as transparent and understandable as possible. To this end, we would propose a reframing of the models described in the previous section so that making choices regarding language and access are clearer, less ambiguous, and easier to understand.

We would argue that the first decision parents need to make should not be about modality (e.g., to sign or not to sign), but rather about which language they want to use to communicate with their deaf child. For most parents, this would be the spoken language of their home, and it would seem natural that this would serve as the L1 for their child. This spoken language might be the same as the majority spoken language of the community (e.g., English), although this is increasingly not the case. Many deaf children come from homes where more than one spoken language is used and the language of the home (and the one the parents can use fluently) is not the majority language. Therefore, it seems counterintuitive to ask parents to interact with their children in a language they do not know [36], and flies in the face of what we know about optimal conditions for language acquisition (i.e., the need for capable users to engage children in meaningful interactions). In any case, the reality is that for most parents of deaf children, a spoken language is the one that is the most natural fit—at least from the perspective of what parents can most readily manage (i.e., they are using a language with their child that they already know) and what is the most expeditious fit in the family context.

The primary channel for accessing spoken language is audition, and for deaf children this access is dependent on hearing technologies. When making a choice for spoken language, parents need to understand that this means making a commitment to managing hearing technologies for their child and ensuring consistent use. That said, eyes can support ears in the process of acquiring a spoken language, and parents should also be introduced to the idea that access to spoken language can be supported visually through gesture, facial expressions, speechreading, fingerspelling, signs, and Cued Speech. For example, in a recent study of 27 deaf kindergartners [37], speechreading predicted phonological awareness and letter knowledge in deaf but not hearing children, and it was identified as a compensatory factor in early literacy for deaf children who are exposed to spoken language across monolingual, bilingual, and bimodal-bilingual contexts.

There is also evidence that using sign can be supportive of auditory input: (1) at different stages of development (e.g., prior to implantation in the early years) [38–40]; (2) for deaf children who are identified later, those who are not as successful using hearing technologies, or students with additional disabilities; and (3) in poor listening environments (e.g., noisy classrooms). Furthermore, there is no evidence that the use of signed language interferes with spoken language development [41,42], and it has been argued that spoken language takes a “piggy-back ride” on signed language [43,44].

While we would agree that spoken language can “piggy-back” on signing, this is only the case if sign is conceptualized as a modality supporting access to the spoken language (i.e., the language is English, and modality is sign). Depending on what the learner needs for access, this signing support can take a range of forms (e.g., from signing only key words to signing most of what is said) and should be compatible with the use of hearing technologies, as spoken and signed modalities occur simultaneously and are mutually supportive. In this way signing does not interfere with the development of spoken language but can be assistive in the access process.

Parents also have the option to choose a natural signed language (e.g., ASL) as the language they want to use to communicate with their deaf child. This choice makes obvious sense for families where the parents are Deaf and/or are fluent users of a natural signed language (e.g., children of deaf adults, or interpreters). As a visual language, it is fully accessible without the use of any hearing technologies, and if the parents already know the language, they can engage their child in the communicative interactions that are necessary
for the language to be acquired. However, many hearing parents do not have this fluency in the language (i.e., it is not the natural language of the home) and developing it can be challenging. In making an informed choice, parents need to understand the substantial time commitment that needs to be made to learning the language. They also need to be reminded that hearing technologies are not a feature of accessing a natural signed language, as there is simply nothing to hear. Not all parents are clear about this fact since many have had the experience of seeing sign used in combination with spoken English.

Parents may also choose a bilingual option and decide to provide access to two languages either simultaneously (i.e., both languages from birth) or sequentially (e.g., introducing a second language at school entry). They may opt for spoken language bilingualism (e.g., English and the language of the home), a phenomenon that has now become much more evident among deaf individuals, suggesting that this can be a viable choice for parents (for a discussion see [45]), or they may choose bilingualism in a spoken and a signed language (e.g., English and ASL), a natural choice for families where parents are native users of a signed language. However, based on their research, Henner et al. [46] suggested that even non-native signers can develop their ASL abilities if exposed to an academic environment before the age of 12, and that if parents place their child in a “good signing program” by age 6, they “can expect that their children will approximate the language skills of native-signing, Deaf children” (p. 12).

In fact, findings of a recent investigation revealed that deaf children of hearing parents exposed to ASL before the age of 6 months (n = 69) had similar expressive and receptive vocabulary scores to the deaf children of deaf signing parents that comprised the normative sample of the ASL-CDI 2.0, an adapted version of the MacArthur Bates Communicative Development Inventory in which scores are derived from parents’ reports of children’s sign use. For the relatively small group of children in the study who were exposed to ASL after the age of 6 months (n = 19), results indicated comparable scores for receptive vocabulary, but not expressive vocabulary [47].

While these findings reflect the potential for deaf infants to acquire ASL vocabulary regardless of parental hearing status, further research is needed to determine the impact of early exposure to ASL on later language proficiency, cognitive development, and academic achievement, particularly in text-based literacy [47]. Furthermore, in making a decision for any form of bilingualism, parents must be made aware that all the conditions for acquisition need to be met in both languages if they are to be acquired, and they must be mindful as to the level of proficiency that will be achieved in each language, whether spoken, signed, or written.

To present these options to parents, we would propose the model displayed in Table 3 (see also [8]). In this model, there are two continuums used to represent languages (e.g., English and ASL). Modalities for conveying the language are also plotted on each continuum from auditory to visual. By presenting the information in this way, it becomes easier for parents to recognize the differences between language and modality, to see how modalities can work in combination to support access (e.g., spoken and signed), and to understand the implications of their choices with respect to the use of hearing technologies. By putting the emphasis on language choice, it also affords a way to think about bilingualism as an option for their child (i.e., providing access to two languages whether they are spoken and/or signed).
Table 3. Language Modality Continuum.

<table>
<thead>
<tr>
<th>English</th>
<th>Visual</th>
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<tbody>
<tr>
<td>Auditory</td>
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<td>Speech</td>
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<td>Visual</td>
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<td>ASL</td>
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Note. See [7] for a previous version of the continuum.

6. Educational Implications

It is well acknowledged that age-appropriate language is a prerequisite foundation for developing reading and writing skills. Historically, available hearing technologies and adopted communication philosophies did not provide most deaf children with meaningful access, which significantly impacted their language development and subsequent literacy outcomes. This literacy achievement phenomenon, commonly characterized as the "fourth-grade ceiling", was first documented by Pintner and Patterson in 1916 [48] and became part of the nomenclature in deaf education for nearly a century. For example, results of large-scale studies of the reading achievement of 8- to 18-year-old deaf students conducted between 1974 and 2003 in the United States revealed that median scores on the reading comprehension subtest of the Stanford Achievement Test for Hearing Impaired (SAT-HI) never exceeded the fourth-grade level for any given cohort [49].

However, as noted previously, with the advent of newborn hearing screening and advances in hearing technologies, significantly more deaf children have the early linguistic access to develop age-appropriate language abilities, and this has resulted in improved literacy achievement. To illustrate the educational implications of improved linguistic access, the findings of several reviews of the literature and the results of recently conducted empirical studies examining the English reading comprehension and written language outcomes for various groups of deaf learners were reviewed. While we recognize the importance of precursor literacy-related abilities (e.g., phonological awareness, word recognition, vocabulary, and spelling), we were primarily interested in capturing the extent to which language choice has impacted conventional literacy achievement, operationalized as outcomes in reading comprehension and written expression.

Therefore, we examined studies reporting achievement levels of deaf students with access to English via spoken language, sign supported spoken language, and those educated using a sign bilingual philosophy in which a natural signed language (e.g., ASL) was used as the primary mode of communication and instruction. We also explored the findings of studies that compared reading achievement across groups representing a variety of modalities. While we did identify a review of the literature summarizing investigations of Cued Speech [50], only pre-literacy skills (e.g., rhyme recognition and spelling) rather than reading comprehension or written expression were measured in the studies that met inclusion criteria (e.g., published in English and employing group comparison or single-case designs). Similarly, a recently published empirical study examining the effects of Cued Speech on literacy achievement of French-speaking cochlear implant users in grades two through five (N = 90) did not report the findings of sentence reading comprehension in a manner that permitted the specific level of skill attainment to be determined, such
as standard scores or grade equivalents [51]. Furthermore, because our main objective was to report the existing evidence of improved literacy outcomes in the current context of improved access, conducting our own meta-analysis of the research was not deemed necessary. In fact, given that the reviews and research investigations discussed in the following sections were published relatively recently (i.e., 2016 and later), we suggest they represent the current state of the knowledge on this topic.

6.1. Spoken Language

In a review of the literature examining the literacy achievement of deaf students with cochlear implants, Mayer and Trezek [52] identified 21 studies conducted between 1997 and 2016 that collectively reported outcomes for more than 1100 deaf learners. To be considered for inclusion, studies needed to use at least one measure of reading comprehension or written expression, be administered to a group of cochlear implant users (i.e., at least 10), and report results in a manner that allowed the level of skill attainment to be determined. Across the 21 studies that included a measure of comprehension, the majority reported mean scores in the average to low average range on standard assessments of reading achievement. In the three investigations that also investigated written expression, two reported weaker outcomes for writing than for reading, although the data reported in all three studies represented improved writing achievement compared to what has been historically reported for deaf students. Even though many studies revealed wide variability in scores across participants in both reading comprehension and written expression, findings across the 21 investigations suggest that improved access to spoken language via cochlear implantation has resulted in improved literacy outcomes for this population of students.

In a second synthesis of studies involving cochlear implant users, Wang et al. [53] conducted a meta-analysis with data from 47 published articles to examine the difference in reading achievement between deaf students with cochlear implants and their typically hearing peers, as well as between cochlear implant and hearing aid users. Specifically, comparisons between students with cochlear implants and their hearing peers were based on data from 43 independent samples that represented approximately 900 cochlear implant users and nearly 2500 hearing peers. Analyses comparing cochlear implant and hearing aid users were based on data from 19 independent samples and represented essentially equal numbers of students, with over 400 participants in each group.

While comparisons conducted as part of the meta-analysis were made across a range of reading skills (e.g., phonological awareness, decoding, fluency, and vocabulary), only those associated with reading comprehension achievement are summarized here. Findings indicated that students with cochlear implants scored statistically significantly lower than their typically hearing peers in reading comprehension; however, there were no statistically significant differences in scores between cochlear implant and hearing aid users. It is also worth noting that while the cochlear implant users reportedly scored 1.39 standard deviations below their hearing peers, their scores still indicated achievement in the average range. In discussing their findings, Wang and colleagues [53] acknowledged that the results of their meta-analysis provided further support for the results reported by Mayer and Trezek [52], suggesting positive shifts in literacy outcomes for deaf students with cochlear implants.

In addition to the review and meta-analysis, three additional studies summarizing the literacy outcomes of deaf students with access to spoken language were reviewed. The first involved 17 students with bilateral prelingual hearing loss age 8;0 to 11;0 enrolled in grades three through five at a private oral school for the deaf. Of the 17 participants, eight were cochlear implant users (mean age 9.25 years) and the remaining nine were hearing aid users (mean age 9.5). Results of the Passage Comprehension subtest of the Woodcock Reading Mastery Test-Third Edition used to assess reading comprehension revealed a mean standard score in the average range (i.e., 85 to 115) in relation to the normative sample. In comparing the performance of cochlear implant and hearing aid users on this measure of reading comprehension, the achievement levels across the two groups were similar [54].
Data for the second and third studies were collected as part of an investigation of literacy achievement of deaf students in grades four through 12 enrolled in a large school board located in central Canada. To investigate reading achievement, the Woodcock-Johnson III Diagnostic Reading Battery (WJ III-DRB) was administered to 70 students, fairly equally divided across three grade bands (i.e., grades four through six, seven to nine, and 10 to 12). Most study participants had bilateral hearing loss (87%), used a personal amplification device (i.e., hearing aid, cochlear implant, or bone anchored hearing aid), and used spoken language as their primary mode of communication. Of the small number of participants who did not use personal amplification, the majority had a unilateral hearing loss. It is also interesting to note that more than 40% of study participants had a home language other than English [27].

Results of the WJ III-DRB revealed mean standard scores in the average range for the Reading Comprehension cluster \( (m = 86.07) \), which is comprised of the Passage Comprehension \( (m = 83.36) \) and Reading Vocabulary \( (m = 91.86) \) subtests. Findings also indicated that participants with unilateral hearing loss outperformed those with bilateral hearing loss. Given that participants were enrolled in grade four and higher, the results of this investigation led the authors to conclude that the majority of students had surpassed the fourth-grade reading achievement ceiling historically reported for deaf learners [27].

In addition to administering the WJ III-DRB to measure reading outcomes, the Spontaneous Writing (SW) composite of the Test of Written Language-Fourth Edition (TOWL-4, Hammill and Larsen, 2009) was also administered to measure participants’ achievement in writing. The SW composite, which includes the Contextual Conventions (CC) and Story Composition (SC) subtests, is derived from an elicited story. After sharing a picture prompt and a sample story, examinees are given a new picture prompt and asked to spend five minutes planning a story and 15 min writing it. Stories are then evaluated using a rubric containing 21 components to assess CC (e.g., spelling and punctuation) and 11 to measure SC (e.g., quality of vocabulary). Because six of the 70 participants were older than the upper age range of the normative sample (17 years, 11 months), data from the investigation of writing was based on 64 participants [28].

Findings of this study of writing indicated that the mean scaled score for the CC subtest fell in the average range, while the scaled score for the SC subtest and the composite index for SW were in the above average range. In fact, a relatively high percentage of study participants obtained scores in the average range or higher (i.e., above average, superior, or very superior) on the CC (89%) and SC (78%) subtests as well as the SW (85%) composite of the TOWL-4, indicating performance commensurate with their hearing peers. When examining the impact of demographic variables on performance, there were no statistically significant differences across groups based on personal amplification, home language, or functional use of hearing, as measured by ratings on the Categories of Auditory Performance [55]. However, differences were noted for gender, type of hearing loss, grade, and additional disability. Specifically, scores for female participants, those with unilateral hearing loss, participants without additional disabilities, and students in grades seven to nine and 10 to 12 (as compared to those in grades four to six) scored statistically significantly higher [28].

6.2. Sign Supported Spoken Language

We were able to identify one recently published study that examined the reading achievement of a cohort of deaf students educated using “simultaneous speech and grammatically accurate sign (i.e., SEE)” [56] (p. 348). This study was conducted at a school for the deaf in the northwest region of the United States and included 17 deaf learners aged 7;6 to 13;9 enrolled in grades two through eight. Apart from the youngest participant, all students had attended the school for at least five years. It was reported that all participants used a personal amplification device and at the time of data collection, 11 were implanted unilaterally. Examining the mean normal curve equivalent (NCE) scores on the comprehension subtest of the Gates-MacGinitie Reading Tests-Fourth Edition (GMRT) indicated that
15 of the 17 participants (88%) were performing within or above the average range when compared to their hearing peers.

### 6.3. Sign Bilingual

In conducting a review of the literature examining the English literacy outcomes of deaf learners educated in sign bilingual programs, Mayer and Trezek [57] applied the same inclusion criteria as their previous review of deaf students with cochlear implants [52] (i.e., at least one measure of reading comprehension or written expression administered to a group of participants, with results reported in a manner that allowed the specific level of skill attainment to be determined). Using these criteria led to the identification of three studies conducted between 2007 and 2017 that represented a total of 127 students. Examining the reading comprehension outcomes in studies conducted in sign bilingual settings indicated that most students were not achieving age-appropriate reading outcomes. For example, in the two studies in which the percentage of students reading at or above grade level were reported, only between 24% and 41% of participants were achieving at this level [58,59]. In the third study in which grade equivalent scores were reported for middle- and high-school-aged deaf learners, mean reading comprehension scores ranged from 2.3 to 4.4 [60].

Since the review of the literature was published, two additional studies were conducted in sign bilingual settings that included a measure of participants’ reading comprehension. Data for the first study were collected in two state schools for the deaf in the United States that “used ASL as the primary language of instruction and focused on teaching English derived from print without spoken English” [61] (p. 161). Participants were 32 students with severe to profound hearing loss ranging in age from 8; 6 to 12; 10 and enrolled in third through sixth grade, with 25% reported as having deaf parents. While multiple measures were used to assess students’ narrative comprehension, vocabulary, ASL receptive syntax, and word reading, the reading comprehension subtest of the Peabody Individual Achievement Test-Revised (PIAT-R) was also administered. This subtest requires examinees to silently read a sentence and respond by selecting one of four pictures. Results of the PIAT-R indicated that 12 of the 32 participants (38%) achieved scores in the average range ($m = 93.08$), while the mean standard score for the remaining 20 participants was considered below average ($m = 73.30$).

The second study conducted in a sign bilingual setting involved 52 middle and high school students ranging in age from 12 to 20 years old from five schools for the deaf in the United States, with one day school and four residential schools represented [62]. Information from informal interviews with participants revealed that the majority had hearing parents (88%), although 47% indicated that at least one person in their home used signed language. It was also reported that the mean age of first exposure to ASL among study participants was 5.98. Included in the language and literacy measures used in this investigation (e.g., academic English, ASL, and reading fluency) was the Level S test form (approximately 9th grade) of the GMRT to measure reading comprehension. Results of this investigation indicated that participants’ scores on the GMRT ranged from 438 (2.5 GE) to 563 (12.0 GE), with a mean score of 469 (3.5 GE). In discussing the findings of the study, the author noted that proficiency in English was a significant predictor of reading comprehension abilities, whereas proficiency in ASL was not.

### 6.4. Cohort Comparisons

In our review of recently published studies, we identified two investigations that compared reading achievement data across groups of students representing different communication modalities. In the first, participants were drawn from a multicenter national cohort of students with cochlear implants to represent those who (1) had their implant activated by 38 months, (2) were administered assessments during both early and late elementary school, and (3) had consistent reports of the communication modality used in the home [63]. Parents of 97 children who met inclusion criteria were asked to provide
information on their child’s exposure to signed language before cochlear implant surgery as well as 12-, 24-, and 36-months post-implant. These data were then used to classify participants into three groups: No Sign \( (n = 35) \), Short-term Sign \( (n = 26) \), and Long-term Sign \( (n = 36) \). Information regarding frequency of daily sign language use (e.g., >50% or <50% of the day) was also collected through parent reports. In addition to measures of early auditory development, speech intelligibility, and spoken language, reading achievement was assessed using the Passage Comprehension subtest of the Woodcock-Johnson Tests of Achievement.

Findings of this study revealed that there was no statistically significant difference in the reading comprehension achievement across the three groups in early elementary, with scores indicating performance in the average range in relation to the normative sample. However, the measure of reading comprehension administered in late elementary reflected a statistically significant difference in the mean standard scores for participants with no exposure to signed language \( (m = 94.9) \) as compared to those in the Long-term Sign group \( (m = 86.0) \). Despite these differences, it is important to note that the standard scores for all participants reflect performance in the average to low average range (>85) in comparison to hearing peers [63].

The second study involving groups of students representing different communication modalities included 336 deaf children between 5 and 9 years old enrolled in kindergarten through second grade in nine states in the United States and one province in Canada [64]. The majority of participants in this investigation were served in congregate, self-contained settings (87.5%), with only 12.5% educated in the general education environment with hearing peers. Based on children’s auditory access to spoken language and exposure to signed language in the classroom, three groups of participants were formed: spoken-only \( (n = 101) \), sign-only \( (n = 131) \), and bimodal \( (n = 104) \). In addition to assessments of language (e.g., vocabulary, receptive and expressive English syntax, receptive ASL syntax, and spoken and fingerspelling phonological awareness), three subtests of the Woodcock Johnson Tests of Achievement III-NU, including the Passage Comprehension subtest, were administered to study participants twice (fall and spring) during one school year.

Results of this study were reported by both communication modality and grade and included the percentage of participants achieving a standard score within the average range (>85) at both fall and spring. In viewing the scores for participants across grades based on communication modality, 65% of those in the spoken-only group, 56% of the bimodal group, and 43% of the sign-only group were achieving at this level. Findings also revealed a decline in reading achievement among study participants both within and across grades. For example, the percentage of students achieving an average standard score in the fall was reported as 86% for kindergarteners, 47% for first graders, and 29% for second graders, whereas the percentage of participants performing at this level in spring reduced to 75%, 36%, and 25%, respectively. In discussing their findings, the authors noted that because the three groups had similar overall language abilities, it appeared that “access to spoken language facilitated learning to read” [64] (p. 346).

7. Conclusions

Much has been made in this article as to why meaningful access to language is such a central feature in the education of deaf students, and how it is at the core of the decision-making process for parents of newly identified children. For a child to acquire any language, this language must be accessible. Considerable energy has been expended in our field debating how this access can best be accomplished, with much of the argument centered on whether this access should be achieved via speech and/or sign. We would contend that this debate needs to be reframed in a context in which hearing technologies have dramatically altered the landscape for linguistic access while continuing to recognize the heterogeneity of the deaf population and the uniqueness of each situation.

While access is a critical element in the language acquisition process, it is not the only factor. It is also vital that language can be used in quality and quantity in meaningful ways
to mediate interactions with a child from as early an age as possible. These interactions are dependent on the child’s parents being able to use the language fluently in order to scaffold the communication and provide a linguistic model [5]. A language may be theoretically accessible, but if parents cannot use it, the necessary conditions for acquisition are not being met.

The reality is that over 95% of deaf children have hearing parents who use a spoken language as their L1, and more and more it is the case that this spoken language may differ from the majority language of the community. For these families, it is often most expeditious to use the spoken language they already know when they are communicating with their child. This requires a commitment to the consistent use of the hearing technologies that are necessary for access. For families whose spoken home language is not the majority language, consideration needs to be given as to how access to both languages can be accomplished to allow for bilingual development to occur.

It would also be important to reassure parents that additional visual modalities including sign can support auditory input, and that this will not interfere with the development of spoken language but can be assistive in the process. However, what also needs to be underscored in this conversation is the difference between language and modality as described in Table 3. Natural signed languages are not accompanied by spoken language, and it is important that parents understand this distinction and the implications of this for the use of hearing technologies.

Parents who choose a natural signed language for their child also need to be made aware that this choice means making a commitment to develop fluency in the language if they do not have it already. It may also be the case that parents choose a bilingual option for their child—simultaneously or sequentially developing a spoken and a signed language. But in making this choice they must be mindful of the requisite acquisition conditions for both and think about how these can be addressed (e.g., balance between the languages, adequate access to auditory input, and opportunities to interact with fluent users of a natural signed language).

As well as informing families about expectations that are inherent in implementing various approaches, they should also be made aware of potential benefits and challenges [28]. The research to date indicates that literacy outcomes are stronger for those children who have developed competence in the spoken language they will be learning to read and write (e.g., English). In the interests of informed choice, this empirical evidence needs to be shared with parents as their decisions about access, language and modality have academic implications.

Moving forward in an era when access to spoken language via technological developments will only continue to improve, it would serve the field well to rethink how we articulate language and modality options to parents. This reframing is needed if we are to most effectively meet the communicative needs of deaf children, while also taking into account the lived reality of their family context.

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