Chapter 12

Understanding Auditory Development and the Child with Hearing Loss

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Key Terms

Auditory access
Auditory environment
Closed-set assessment
Comprehension
Detection
Discrimination
Functional auditory assessment
Hearing age
Identification
Open-set assessment
Telescope vocal development

Objectives

- Understand how auditory skills develop in typically developing children with normal hearing
- Understand and describe the relationship between listening and spoken language
- Understand the elements that need to be in place for a child with hearing loss to learn language through audition, and the rationale for doing so
- Describe functional auditory assessment, and the tools and methods available to complete it

Introduction

Spoken language acquisition happens for the typically developing hearing child in such an integrated, progressive manner that how the child receives, perceives, and processes the auditory sensory input from his or her environment may be taken for granted. In the case of children with hearing loss, a strong understanding of the impact of hearing loss on auditory spoken language acquisition is essential, as well as how to optimize the listening capacity and auditory skills development for the individual child who is deaf or hard of hearing. Just as for the hearing child, the mother language can be learned through the primacy of the auditory channel; the brain can learn to use an auditory signal that arrives through hearing instruments and auditory development can be followed. The concept that spoken language is primarily an auditory event underlies the practices of professionals who provide early auditory-based intervention and auditory–verbal education to children with hearing loss who are learning to listen and speak. How do we use our understanding of typical auditory learning to assist children with hearing loss to access the auditory code-cracking potential of their brains?

This chapter will present an overview of the following topics: auditory development in typically developing children with normal hearing, auditory development in children with hearing loss, a model for auditory work with children with hearing loss, the use of developmental hierarchies and checklists in tracking auditory skills, and functional auditory skills assessment tools. We will also provide several resources at the end of the chapter.

Auditory Development in Typically Developing Children

In the past 20 years, there has been a great deal of research concerning the prenatal auditory environment and the earliest weeks and months of auditory development. These findings confirm the importance of paying attention to the earliest stages of auditory development (Boothroyd, 1997). There are several general assumptions that inform us about early auditory pathway development and ongoing auditory learning. First, we now assume the innate capacity of the human brain to perform categorical speech perception (Owens, 2012). Second, the timetable of auditory development needs to be considered from the formation of the auditory system in utero and the auditory experiences with sounds that are possible through the uterine wall. We can assume that, even before birth, a child is listening to it's mother's heartbeat and attending to mother's voice, music, and other speech and nonspeech sounds and even stories that are loud enough to be heard (Saffran, Werker, & Werner, 2006). Third, research into auditory pathway development in utero and the first few years of life emphasizes the critical period for auditory neural pathway development (Sharma, Dorman, & Kral, 2005). Fourth, cross-linguistic research on auditory perceptual abilities of infants in the first days and weeks of life informs us that the neonate is indeed an amazing sound processor and can perform a larger variety of perception tasks than previously thought. Auditory abilities that are more complex than auditory awareness are already present at birth (Welling, 2010). The presence of a hearing loss at birth, therefore, means that the auditory brains of these children have not benefited from diverse auditory input and listening practice; hence the crucial need for early detection and early intervention.

What do we know about auditory development and the typical child with normal hearing, and how does that inform us about the child with hearing loss? For the child whose hearing loss is detected early and who is able to access sufficient auditory input, we would want to follow a developmental model. It is useful to think about how the auditory–verbal link develops and how auditory input is linked to speech and spoken language output. The following is a useful way to conceptualize this:

Input

1. Auditory perception (ability of the ear to hear the speech signal)
2. Auditory processing (ability of the brain to understand speech and spoken language)

Output

1. Speech and spoken language organization (ability of the brain to organize speech and spoken language)
2. Speech and spoken language production (ability to produce nonmeaningful speech sounds and meaningful speech in spoken language)

As we observe children at various ages and stages of development, our observations of their speech and spoken language output can be an indicator of the auditory input they

are receiving and how they are processing that input. If the auditory input is compromised, then spoken language output will be negatively impacted.

Table 12.1 contains a list of aspects of auditory development related to concurrent attainments in speech production and spoken language. This developmental information is a reference for later discussion of how listening and speaking can be developed in hearing loss. For further details the reader is referred to Owens (2012), Cole and Flexer (2011), Oller (1986), and Hall and Moats (1998).

Auditory Development of Children with Hearing Loss

Understanding the course of auditory development in the typically hearing child should inform best practices of speech pathologists, audiologists, teachers of the deaf, auditory-verbal therapists, early interventionists, and listening and spoken language specialists. Our challenge in working with children who are deaf or hard of hearing is to ensure early identification of hearing loss, early and consistent use of advanced hearing instruments, early access to auditory-based language learning in the home environment, and access to knowledgeable and skilled professionals.

Children born with hearing loss, even a minimal hearing loss, are at risk for not achieving all the essential auditory abilities outlined in Table 12.1. Early identification of hearing loss through newborn hearing screening, and the provision of early intervention programs and advanced hearing technologies, have played a part in changing our expectations of children with all levels of hearing loss and of the age of attainments. The mission of the state Early Hearing Detection and Intervention (EHDI) programs is: detection of hearing loss by 1 month of age, diagnostic audiology and hearing aid wearing by 3 months of age, and enrollment of the child and family in an early intervention program by 6 months of age (Joint Committee on Infant Hearing, 2007). Early intervention, prior to 6 months of age, has been shown to afford children with hearing loss the opportunity to achieve language levels comparable to their hearing peers (Downs & Yoshinaga-Itano, 1999; Yoshinaga-Itano, Sedey, Coulter, & Mehl, 1998). Failure to provide infants with hearing loss the early auditory input necessary for the development of their auditory brain centers (and subsequent skills in listening, spoken language, and literacy) has been dubbed a "neurological emergency" by Dornan (2009).

Auditory input is best accessed during the years of the greatest neural plasticity. The detrimental effects of auditory deprivation due to hearing loss have been well documented. Hearing loss can have a negative effect on the development of the child's auditory system (Moore & Linthicum, 2007) and on the development of listening, speech, spoken language, literacy, and academic achievement (Blaiser & Culbertson, 2013; Ling, 2002; Paul & Whitelaw, 2011; Robertson, 2009).

Studies and intervention with children who have various levels of hearing loss can inform us about how hearing develops. Sharma and colleagues (2002a, 2002b, 2005, 2006) have studied severe to profoundly deaf children who received cochlear implants and confirmed that there is a critical period for auditory development. Children who received cochlear implants prior to 3 1/2 years of age developed "auditory brains" similar to those of hearing children; those older than 7 years of age did not.

Better speech perception and language skills have also been achieved by children who received cochlear implants early (Fryauf-Bertschy, Tyler, Kelsay, & Gantz, 1997; Kirk et al., 2002; Nicholas & Geers, 2006). The same type of improved outcome has been shown in studies of children who

Table 12.1 Auditory-Verbal Development in Typically Developing Children with Normal Hearing

	Input: Auditory Development	Output: Speech Production/Spoken Language
Prenatal	*Auditory Experiences in Utero:* • Typically developing child has 20 weeks of exposure to auditory stimuli prior to birth • Infant emerges literally wired for sound • Listens to mother's voice and environmental sounds (both from within and outside of the womb) • Born with a preference for mother's voice • Born with a preference for songs and stories heard in utero	

(*continues*)

Table 12.1 (*continued*)

	Input: Auditory Development	Output: Speech Production/Spoken Language
Birth to 3 months	*Reactions to Sounds:* Startle reflex, eye blink/eye widening, cessation of activity, limb movement, head turn toward or away, grimacing/crying, sucking, arousal, breathing change *Speech Perception Abilities:* • Can identify individual phonemes • Capable of detecting virtually every phoneme • Prefers vowels *Prosody/Suprasegmentals:* • Prefers human voice • Attentive to the rise and fall of intonation pattern • Attends to patterns of speech • Prefers native language to all others *Identification:* • Identifies mother's voice • Prefers songs heard prenatally	*Reflexive:* • Coos, gurgles, reflexive sounds *Physical Response to Sounds:* • Stilling, rhythmic movement, searching for sound's source *Vocalization:* • Goo sounds, laughter • Quasi-resonant nuclei (QRN), immature vowel-like sounds
3–4 months	*Prosody/Suprasegmentals:* • Prefers utterances with intonation variation versus flat voice • Discriminates high and low sounds	
4–7 months	***Early Auditory Feedback*** *Auditory Tuning In:* • Listening to language for longer periods of time • Shows awareness of environmental sounds • Can be behaviorally pacified by music or song *Speech Perception:* • Recognition of mother's voice • Reacts to vocal mood differences *Localization:* • Localization to sound begins to emerge from eye gaze to head turn to localization to specific sound sources (directly related to motor development) *Auditory Memory:* • Beginning of auditory memory (distinguishes between voices of familiar people vs. strangers)	*Expanding Vocal Repertoire:* • Vocal play • Fully-resonant nuclei (FRN), vowel-like sounds, consonant-like sounds, consonant-vowel (CV) and vowel-consonant (VC) syllables emerge • Plays with streams of sounds, intonational patterns, raspberries, squeals, loudness play • Vocal turn-taking exchanges with parent
5 months	*Early Auditory Comprehension:* • Responds to own name *Suprasegmentals/Prosody:* • Discriminates own language from others with same prosody	*Vocalization:* • CV syllable and some VC syllable vocalizations • Imitates pitch tone
6 months	Correlation between achievements and speech perception and later word understanding, word production, and phrase production *Speech Perception:* • Preference for vowels ends *Early Auditory Feedback:* • Listens to self in vocal play *Auditory Identification:* • Begins to recognize own name and the names of family members *Reliable localization:* • Begins to respond to directives *Selective auditory attention:* • Will divert attention from one activity to a more desirable activity based on auditory input.	*Vocalization:* • May produce recognizable vowels: /u/a/i/

(*continues*)

Table 12.1 (*continued*)

	Input: Auditory Development	Output: Speech Production/Spoken Language
	The Sound with Meaning Connection: The "melody is the message." Child will interpret parents' intention by listening and reacting to tone of voice change. Happens prior to word comprehension.	
8–10 months	*Synaptogenesis:* • Explosion of synaptic growth may be related to change in perception and production *Phonotactic Regularities and Prosody:* • Sensitive to regularities in word boundaries in infant-directed speech (IDS), even in another language • Begins storing sound patterns for words, although no meaning yet *Auditory Comprehension:* • Begins to comprehend words	*Vocalization: Canonical "Babble"* • Achieves strings of reduplicated and alternated syllable production; timing of syllable production sounds speech-like, stress patterns • Vowels, consonants becoming distinct *Increased Vocal Turn-Taking:* • Once true babble attained, parents expect more speech-like utterances. *Primitive Speech Acts (PSA):* • Expressing intentions nonverbally
8–14 months		*Protowords:* • Words invented by child, not adult, but have consistent meaning, such as "la-la" for blanket
9 months	*Speech Perception:* • Prefers nonwords composed of high phonotactic components *Auditory Attention:* • Sustained auditory attention • Will attend to auditory-based activities for increased periods of time *Phonotactic Probabilities* • Predicting likelihood of certain sound sequences, listening preference for nonwords with high phonotactic probability versus those with low probability	*Intentionality: "I Know What I Mean":* • Child attains cognitive/communication intents. • Achieves means–end concept • Uses vocal/verbal means to achieve ends in combination with visual and gestural mechanisms *Vocalization:* • Variegated babble: adjacent and following syllables are not identical
9–12 months		*9–12 months: Speech to Communicate* • Sound imitation of common household items and animals • Distinct word approximations and in some cases early single word utterances take place of crying to fulfill wants and needs • Verbal "nicknames" for distinct objects and people develop and remain consistent for that object or person
10 months	*Auditory Tuning In:* • Narrows auditory attention and speech perception: tunes in to mother language, loses universal interest in all speech sounds	
10–16 months		*Phonetically Consistent Forms (PCF):* • Speech sounds that have sound–meaning relationships, such as "puda" for the family cat *First Words:* • Context bound • Following the first word, during the next few months, children add an average of 8–11 words to their vocabularies each month
11 months	*Speech Perception:* • Identifies allophones and word boundaries	• Variegated babble • Word approximations
12 months	*Speech Perception:* • Hears word and consonant boundaries	

(*continues*)

Table 12.1 (*continued*)

Ages 12–24 months: Exploring and Expanding

	Listening: Auditory Comprehension	Speech Production and Spoken Language
12–18 months	*Early Auditory Comprehension:* • Odd mappings of words • Child attends to whole sentence • Is able to follow commands • Fully aware of the names for familiar objects and family members *Auditory Environment:* • Derives obvious pleasure from auditory activities like music, playing with friends, laughing, and being read to *Auditory Experience:* • Listening to speech for long periods of time is essential to the ultimate use of even single words	*Overextension and Underextension of Words:* • Language develops as a direct correlation of using that developing speech to ultimately gain a desired outcome through a communication interaction between the speaker and the listener *Gradual Decontextualization (to 18 months):* • Says first clear, distinct word and assigns that word to a single distinct object or person
16–20 months		*Fast Mapping:* • Ability to learn words in one or few exposures
18 months	*Auditory Vocabulary:* • Tremendous growth in vocabulary comprehension, 100–200 words understood	*First 50 Words Used: A First Language:* • Growth in expressive ability • Tremendous growth in one-word usage
18–24 months	*Auditory Localization:* • Will independently seek out a sound source in another room *Auditory Comprehension:* • Understands and follows verbal directions with two critical elements • Begins to respond appropriately to "What, where" questions	*Word Spurt: Vocabulary Spurt* • "Naming theory" seems to be a basis for noun usage, naming people, objects; occurs for most children when they hit the first 50 words mark • Will begin to sing along with songs or mimic the rhythm of a nursery rhyme

Ages 2–3

	Listening	Speaking
24–36 months	*Auditory Identification:* • Will identify a sound and share that identification with another person with exuberance • Desires to share auditory information with another person *Auditory Memory:* • Will share auditory experiences from memory (left brain) • Will sing complete or nearly complete songs from memory (right brain)	*Cognitive/Semantic:* • Two-word semantic relations, and three-word-plus utterances *Spoken Language and Play:* • Will hold a seemingly appropriate conversation with an inanimate object while playing *Presyntactic period*
26–32 months		*Phoneme repetition:* • Vocabulary size seems related to ability to repeat phoneme combinations, especially initial position in nonwords
By 36 months		*Early Syntactic:* • Recombination of two-plus-two word utterances • Early multiple word utterances, correct word order *Early Morphology:* • "ing"

Ages 3–4: Peers, Preschool

	Listening	Speaking
3–4 years	*Auditory Memory:* • Begins to show listening preferences for favorite stories or music and will follow simple aural commands *Auditory Attention:* • Development of sustained auditory attention for increasing periods of time *"Overhearing" or "Incidental" Learning Through Listening:* • Does not need to be involved in direct instruction or directly in a conversation to pick up on what is happening; uses words, expressions not directly taught	*Pragmatics:* • Able to hold an appropriate turn-taking conversation with a peer; continuing to develop conversational competence ***Cognitive Semantic*** *Phonology:* • Phonetic repertoire mastered for some phonemes • Phonological processes occurring

(*continues*)

Table 12.1 (*continued*)

	Listening	Speaking
	Auditory Feedback Mechanism: • Development of auditory feedback mechanism • Development of phonemic awareness and temporal processing *Distance Listening:* • Ability to search the auditory environment for information even if engaged in activity	*Preliteracy:* • Recitation by rhyme • Rhyme by pattern • Alliteration *Early Syntactic Child:* • Increased morphological use, correct sentence word order • Begins to produce increasingly complex sentences that adhere to spoken language rules
4–5 years	*Achieves Metalinguistic Ability Through Audition:* • Recognizes and can report when he or she hears someone make an error or slip of the tongue in spoken language • Uses auditory cues in conversations to recognize prosodic, pragmatics, semantic and syntactic errors in adult and peer speech	*Pragmatics/Discourse:* • Follows adult conventions for conversation mechanisms; able to take role as "conversational partner" *Preliteracy: Phonologic Awareness* • Syllable counting (50% of children by age 5)

Ages 5–6: Preacademic Readiness

	Auditory Developments	Speaking
5–6 years	*Auditory Attention:* • Development of an attention span for instruction, even if the topic is not of high interest *Auditory Memory:* • Stronger development for long-term auditory memory of linguistic information *Internal Auditory Feedback:* • Development of internal auditory feedback (reading voice in head); auditory self-correcting	*Pragmatics/Discourse:* • Oral narrative more developed *Early Literacy: Phonologic Awareness* • Initial consonant matching • Blending 2–3 phonemes • Counting phonemes: 70% of children by age 6 • Rhyme identification • Onset-rime division *Syntax* • Increasing mastery of complex language forms: relative clauses, coordination, subordination, use of the infinitive verbs • Increased mastery of language systems: tense marking, modals and semimodals, pronouns, determiners

Ages 7 and Up: Refining Auditory Skills

7 years	*Assessable Auditory Processing Function:* • Higher level auditory skills are mostly developed and intact: dichotic listening, auditory figure ground, selective auditory attention *Phonemic Awareness:* • Sound blending, sound symbol association *Prosody and Suprasegmentals* • Ability to sense vocal sarcasm • Ability to resist heavy accent and follow conversation (decoding and closure) *Auditory Lexicon:* • 14,000 words (approx.)	*Phonologic Awareness:* • Blending 3 phonemes • Segmentation of 3–4 phonemes (blends) • Phonetic spelling • Phoneme deletion *Syntax:* • Expressive vocabulary
8 years	*Auditory Processing Overload Strategies:* • Develops compensatory strategies when faced with the challenge of auditory processing overload • Uses volume independently to aid in focus and attention *Auditory Attention for Music* • Begins to have an "ear" for music, auditory attention for musical instruction	*Phonologic Awareness:* • Consonant cluster segmentation • Deletion with clusters

(*continues*)

Table 12.1 (*continued*)

	Auditory Developments	Speaking
9 years	*Auditory Input Primary for Instruction:* • Auditory begins to become the primary input system for classroom instruction • Higher level auditory visual integration skills for organization management like note taking • End of the right ear advantage	

Data from Owens, R.E. (2012), Language Development: An Introduction, Allyn and Bacon; Cole & Flexer (2011), Children with Hearing Loss: Developing Listening and Talking,Plural Publishing; and Oller (1986), Metaphonology and infant vocalizing, in Precursors of Early Speech, ed. Lindblom, B., and Zettersrom, R., Stockton Press.

received auditory–verbal therapy (Rhoades & Duncan, 2010) from an early age. These children achieved language levels commensurate with hearing peers (Dornan, Hickson, Murdoch, & Houston, 2007; Duncan, 1999; Rhoades & Chisolm, 2000) or went on to mainstream education and higher education (Goldberg & Flexer, 1993, 2001).

Rationale for Teaching Language Through Audition

How is it possible to achieve spoken language outcomes as described in the previous section with children who are deaf or hard of hearing? First, and most important, typically developing children learn speech and spoken language through audition, and it is the most effective way to acquire this competence and performance (Ling, 2002). Audition is so essential in this task that even a mild hearing loss can compromise spoken language learning (Flexer, 1995). It is possible for the child who is deaf or hard of hearing to acquire auditory spoken language because of the redundancy cues contained in spoken communication: communication context and intent, semantic content and noun–verb meanings, stress–time information, intonation patterns, word order regularity, phonotactic probability knowledge, reading body language, facial cues, tone of voice, and motivation to understand (Fry, 1978; Ling, 2002; Ling & Ling, 1978). We can give them access to the sounds of the speech input signal and, even if this not perfect, children with hearing loss can learn to fill in the gaps or "get the gist." Auditory comprehension improves as the child learns to use linguistic cues and the rules of language (Ling, 2002).

Second, the link between speech perception and production (as presented previously) is vital. Table 12.1 demonstrates how the infant increasingly tunes in to the cues for speech, initiates the process of development of control of motor speech, and uses vocal/speech behaviors to communicate in year one of life. The child's speech output in year one lags behind his or her auditory learning. First we listen, then we talk. Also, the infant's anatomy and physiology for speech production need to develop to enable more mature sound imitation. This is coupled with the increasing use of immature, then more mature vocalizations as a way to participate in communication with parents. There is evidence for a 15-month-old child with a severe hearing loss to **telescope vocal development**; within only 15 days of hearing aid wearing, she progressed from immature verbalizations to the production of the entire range of year one vocal behaviors (Paterson, 1992). This is evidence that a more biologically mature child was able to start catching up once her brain was able to access sound and spoken language input.

Audition assists speech acquisition. Children use hearing to help match their speech to adult models in their environment (Pollack, Goldberg, & Caleffe-Schenck, 1997). Children tend to talk the way they hear (Ling, 2002), so accurate input is needed for the child to develop appropriate speech and spoken language skills. The computer has been used as an analogy for this process; there is a saying from computer science: "garbage in, garbage out." In other words, if the child does not have **auditory access** to the complete speech signal, his or her ability to process that information and then produce accurate spoken language is compromised. In this type of scenario, acquiring adequate speech and spoken language skills becomes an arduous task (Cole & Flexer, 2011).

Third, most children with hearing loss can benefit from current hearing technologies. For children with profound losses, cochlear implants from an early age and appropriate auditory intervention have been shown to provide the auditory access needed for the development of listening and spoken language (Dornan et al., 2007; Nicholas & Geers, 2006).

Fourth, today the majority of children who are deaf or hard of hearing are using spoken language to communicate and are learning in regular education settings with typical hearing children (Gallaudet Research Institute, 2008; Luckner, 2010). We know that 92–96% of children with hearing loss have hearing parents; perhaps this is why most parents are choosing spoken language options (Mitchell & Karchmer, 2002). This trend means that many training programs are seeing the need to adjust their models and curriculum. Many deaf and hard of hearing students may be supported by professionals who do not have training in listening, speech, and spoken language development (Houston & Perigoe, 2010a, 2010b). In fact, there is federal awareness (Joint Committee on Infant Hearing, 2007) that there is a shortage of specially trained professionals who understand how to facilitate learning with advanced hearing technology with the birth to 5 years population. The same need exists to train flexible professionals who have a strong foundation of knowledge and skills in developing and maintaining development of listening and spoken language from birth through high school (Houston & Perigoe, 2010a, 2010b; Paterson & Cole, 2010).

What are some of the essential best practices and knowledge to ensure that each child with hearing loss can achieve optimal auditory development in the spoken language acquisition process? The following section will propose a framework for auditory skill development and suggest some tools for ongoing diagnostic assessment and auditory-based intervention.

A Framework for Auditory Skill Development

A model for auditory work originally suggested by Hirsh (1970) as a framework for adult aural habilitation and popularized by Erber (1982), Ling (2002), Ling and Ling (1978), and others still forms the starting point for current models and hierarchies used for younger children with hearing loss.

Although the levels in Table 12.2 are often presented as a hierarchy of development, they do, in fact, overlap. It is critical that the child who is deaf or hard of hearing develop awareness of sound and attention to auditory input as a foundational skill; however, it should be remembered that, like children with normal hearing, children with hearing loss do not necessarily develop these skills in a strictly hierarchical manner. In other words, they are developing all four levels of skill—detection, discrimination, identification, and comprehension—at the phoneme level, word level, sentence level, and discourse level concurrently. For example, the child may be working on *detection* of sound over distance, developing his or her ability to *identify* by imitating and alternating syllables that begin with various consonants (phoneme level), *discriminating* between words that differ in voicing of the initial consonant (word level), and demonstrating *comprehension* by recalling three critical elements in a message (sentence level) and by identifying an object from several descriptors (discourse level). This is because a child may be developing skills at more than one level simultaneously (Cole & Paterson, 1984; Paterson, 1982; Welling, 2010).

The expanded framework shown in Table 12.3 reflects this need for movement among all of the levels. We should not get stuck at the level of word discrimination, but move the child toward auditory comprehension of connected discourse. It can be used for assessment, goal setting, lesson planning, and intervention and incorporates the Hirsh (1970) and Erber (1982) levels with Ling's (2002) speech production model.

Typically developing children with normal hearing will develop listening skills within natural language contexts.

Table 12.2 Levels of Auditory Skill Development

Four Levels	Definition
Detection	The ability to perceive the presence (or absence) of sound. Detection tasks are often used when conditioning a child to sound when a child's verbal response is not required.
Discrimination	Involves the ability to determine whether two stimuli are the same or different. These can be two environmental sounds, two speech sounds, two words, two phrases, two sentences, or two songs/rhymes, for example.
Identification	Involves the child's ability to identify what has been labeled or named. This is sometimes called *recognition*.
Comprehension	The highest level of auditory processing. The term is generally used when talking about understanding the meaning of the auditory input and application to known information, experiences, and language. Anderson's (2004) checklist in Appendix B of this chapter provides further information on types of auditory comprehension.

Table 12.3 Framework for Developing Listening: Assessment, Goal Setting, Lesson Planning, and Intervention

	Sounds Nonspeech Speech	**Syllables** Nonsegmentals Segmentals	**Words** Content Function Semantics Morphology	**Phrases** Carrier Chunking Clauses	**Sentences** Increasing syntactic complexity Pragmatics	**Connected Discourse** Conversation Narration Explanation/ Directions Description Questions All aspects of language Songs/rhymes
Detection						
Discrimination						
Identification						
Comprehension						

Adapted from the following: Erber, N. (1982). Auditory training. Washington, DC: Alexander Graham Bell Association for the Deaf.; Ling, D. (2002). Speech and the hearing-impaired child: Theory and practice (2nd ed.). Washington, DC: Alexander Graham Bell Association for the Deaf.; Romanik, S. (2008). Auditory skills program for students with hearing impairment. Moorebank, Australia: New South Wales Department of Education and Training. Available from: http://www.schools.nsw.edu.au/media/downloads/schoolsweb/studentsupport/programs/disability/audskills.pdf

Children with hearing loss may need more structured listening settings for the practice of such skills. Generally, the older the child and the less well he or she uses his or her hearing, the more structured or formal the intervention will need to be (Ling, Perigoe, & Gruenwald, 1981).

Today, we have infant learners who may follow a more typical auditory–verbal learning trajectory, but we also still see children who are late starters. These may be children whose hearing losses were not detected until later, those with progressive hearing losses, those who develop hearing loss later, and those who (for whatever reason) start their auditory experience as toddlers or preschoolers. Auditory intervention may need to be more planned or structured for those who start later, while still being founded on a developmental, conversational model of spoken language acquisition (Paterson, 1982).

We have found the Auditory Learning Guide (ALG), which Walker (2009) adapted from work by Simser (1993), to be helpful in setting goals across several auditory skill levels. The ALG is reprinted in Appendix A at the end of this chapter, and should serve as a useful guide.

Conditions for Implementing the Model

What conditions are necessary for success in using this model of auditory skill development? Professionals working with the family need to ensure maximal auditory access with appropriate hearing technology, develop skill in using the Ling Six-Sound Test (Ling, 2006), provide an optimal auditory environment, and implement plans based on diagnostic information that incorporates the concept of hearing age or listening age.

Auditory Access

Ensuring that each child who is deaf or hard of hearing has optimal access to the speech signal through appropriate advanced hearing technology is a key principle of auditory-based learning approaches. What are the factors, protocols, assessment tools, and concepts involved in ensuring optimal auditory access? The factors include access to and consistent wearing of appropriate individual hearing instruments, monitoring of the child's auditory learning through the hearing device(s), appropriate ongoing audiologic management, and sufficient auditory input of language.

Current medical treatments and hearing technologies are now so sophisticated (with hearing aids, bone-anchored hearing aids, assistive listening devices, auditory training devices, sound field systems, cochlear implants, and brainstem implants) that the majority of children with hearing loss can be provided access to sounds across the entire spectrum of speech. Consistent use of appropriate hearing technology to provide this access is the critical first step in developing listening and spoken language in children with hearing loss. Cole and Flexer (2011) discuss this current availability of new hearing technologies as creating a new "acoustic conversation"—one in which children who are deaf or hard of hearing can function (with technology) as though they have only a mild or moderate hearing loss. Today, we can expect children who use cochlear implant(s) to achieve excellent vowel discrimination and to discriminate the high-frequency bursts that enable place discrimination among /p, t, k/, as well as the high-frequency turbulent noise for perception and discrimination of

fricatives, such as "sh" and /s/. On the other hand, it is now the child who is wearing hearing aids who may have no or little access to high-frequency speech information and who may struggle to make those same discriminations. Because a greater amount of speech information is concentrated in the higher frequencies, access to speech sounds above 2000 Hz is needed to make the fine discriminations necessary for processing speech (Killion & Mueller, 2010).

Daily Perceptual Check of Detection and Discrimination: The Ling Six-Sound Test

It has become common practice for parents and professionals working with children with hearing loss to perform a daily morning listening check of the child's ability to detect or discriminate through their hearing instruments. The Ling Six-Sound Test (Ling, 2006) has become the established protocol. The sounds are arranged here in order, representing the lowest frequency of speech to the highest: /u/, /m /, /a/, /i/, "sh," and /s/. These six sounds represent the frequency range of the entire speech spectrum. Some professionals have added "silence" as another sound to check for false-positive responses (Cole & Flexer, 2011). This test has become popularized, and various versions and explanations of usage exist, both in print (Ling, 1989, 2002, 2006) and online (Advanced Bionics, 2012; Cochlear Corporation, 2012).

Each child who is deaf or hard of hearing is a unique listener. It is possible to identify speech perception problems by noting any auditory confusion while doing the test. One known phenomenon can be diagnosed as in the following example. In the administration of the Six-Sound Test, you say the /u/ vowel and the child repeats /u/. Then, you say the /i/ vowel and the child says /u/, not /i/. You repeat this several times and the child still cannot discriminate the /i/ from the /u/. Why does this happen? The child is able to perceive both the low-frequency, first formant (F1) and the mid-frequency second formant (F2) of /u/. However, /u/ and /i/ have a similar, low-frequency first formant (F1), which is created by resonance in the pharynx. The second formant (F2) resonates in front of the tongue. The /i/ vowel is a high, front vowel and the tongue constriction creates a high F2 at about 2700 Hz. A child who cannot hear at this higher frequency will not be able to tell /u/ and /i/ apart; therefore, these two vowels will sound the same. This is an example of how knowledge of speech acoustics is essential for working with the child who is deaf or hard of hearing.

Understanding Acoustic Cues for Prosody and Redundancy in the Speech Signal

As we saw earlier in Table 12.1, infants tune in to the prosodic features of parent talk and begin to deduce meaning in context before they are developmentally able to focus on word boundaries. Auditory development in the earliest stages seems based on the "melody of the message" (Fernald, 1989). This is why babies like songs, rhythm, repetition, sing-song voices, and all the vocal variations that adults use in infant-directed speech (Cole & Flexer, 2011; Owens, 2012). Infants do not start by listening for phonemes or suprasegmental features in isolation. In fact, it seems easier for them and for us as adults to tune in to the spoken message if there is more acoustic information to work from. The child with hearing loss needs the same opportunity to learn to deduce meaning from spoken input that is sufficiently long enough to convey essential prosodic information. As you can see in **Table 12.4**, prosody carries an enormous meaning load in English (Cole & Paterson, 1984), from the intonation contours that are created when we produce different sentence modalities, to the crucial stress-timing features that are a hallmark of English. The table indicates that acoustic cues for prosody are in the low- and mid-frequency range, where almost every child who is deaf or hard of hearing has auditory access. In fact, these prosodic cues are *only* available to us through auditory perception (Ling, 2002), and it is almost impossible to speech-read them. It is crucial that professionals working with all ages of children who are deaf and hard of hearing understand how prosody occurs and the important role it plays in auditory comprehension of connected discourse (Paterson, 1986).

Here is a quick exercise to help with the concept. The difference in meaning in the identical utterances listed in **Table 12.5** is comprehended by the listener through attention to the redundant prosodic and linguistic cues. The meanings are:

1. *Possession:* Tell me who owns the object.
2. *Modify the noun:* Tell me which object.
3. *Identify the object:* Tell me what you own.

Linguistic cues: the word order creates the sentence pattern for transitive sentence and statement and helps the listener predict what information will follow. The pronoun *I* signals who (subject) and signals that a verb is coming; the verb *have* signals possession and that an object is coming; the adjective *blue* signals that a noun is coming. However, additional suprasegmental changes are produced that we listen to as prosodic cues: Stress marking of the key word in the

Table 12.4 Prosodic Feature Comparison: The Acoustic Cues for Perception and Production

Suprasegmentals of Speech in Isolation	Prosodic Features as They Appear in Spoken Language	Acoustic Terms and Measurement	Acoustic Information Required to Perceive and Discriminate Speech Sounds/Prosody, Related to Audiogram	Anatomy and Physiology: Part(s) of the Speech System Involved in Production
Vocalization	Overall vocal quality, timbre • Oral vs. nasal sounding • Not harsh	Fundamental frequency, Fo: Measured in cycles per second (cps) or Hertz (Hz)	Male voice: 100–120 Hz Female voice: 160–200 Hz Child voice: 300 Hz	• Vocal folds • Phonation
Duration	Timing changes: • Rhythm • Rate of speech • Pause patterns • Juncture	Duration: Measured in milliseconds (msec)	Voicing: 250 Hz 500 Hz	• Vocal folds, phonation • Breath/air flow • Dynamic force in lungs
Intensity	Stress marking: • Marking primary stress in words Voice loudness variations: • Whisper • Soft voice • Normal conversational voice • Loud voice • Outdoor voice	Amplitude: Measured in decibels (dB)	Voicing: 250 Hz 500 Hz 1000 Hz	• Vocal folds, phonation • Breath/air flow • Subglottal pressure variations

Pitch	Intonational contour variations:
	• Appears across utterances and sentences, and between sentences
	• Each sentence modality has a unique intonation pattern:
	  • Statement pattern
	  • Question pattern
	  • Command pattern
	  • Negative pattern
	Tone of voice:
	• Affect: joy, sadness, sarcasm, etc.
	Habitual vocal pitch:
	• Appropriate for age
		Frequency: Measured in Hertz (Hz)	Voicing:
			250 Hz
			500 Hz
			1000 Hz
				• Vocal folds, phonation
				• Breath/air flow
				• Vocal fold tension
				• Vocal fold mass changes

Adapted from the following: Cole, E. B., & Paterson, M. M. (1984). Assessment and treatment of phonologic disorders in the hearing impaired. In J. Costello (Ed.), Recent advances in speech disorders in children (pp. 93–127). San Diego, CA: College-Hill Press.; Ling, D. (2002). Speech and the hearing-impaired child: Theory and practice (2nd ed.). Washington, DC: Alexander Graham Bell Association for the Deaf.; Ling, D., & Ling, A. H. (1978). Aural habilitation: The foundations of verbal learning. Washington, DC: Alexander Graham Bell Association for the Deaf.; Paterson, M. M. (1986). Maximizing the use of residual hearing with school-aged hearing impaired children. Volta Review Monograph, 88(5), 93–106.

Table 12.5 Prosody: The Importance of Suprasegmental Changes for Understanding Language

Phrase	Meaning	Word Class
1. I have a blue <u>car</u>.	Tells me the object	Noun
2. I have a <u>blue</u> car.	Tells me which object	Adjective
3. <u>I</u> have a blue car.	Tells me who owns the object	Personal pronoun

Underline indicates primary stress marking.

utterance (mostly a rapid intensity change with duration); intonation contour across the utterance, which signals sentence pattern as a statement; and interaction of duration and intonation pattern, which carries the tone of voice or attitude of the speaker (boasting, happiness, etc.). Try producing these utterances with a flat voice and then with appropriate prosodic features. See how much you rely on the acoustic cues to quickly identify, discriminate, and comprehend.

Auditory Environment and Auditory Input

The term **auditory environment** has come into recent use to describe the child's listening situation, both in the home and, later, at school. Once the family and child with hearing loss have gone through screening, diagnostic audiology, and fitting of amplification or cochlear implant, long-term habilitation or intervention provides the regularity of support for parent and child (Cole, Carroll, Coyne, Gill, & Paterson, 2004). One of the first goals is to help the parent understand the importance of creating an optimal auditory environment. This means more than just having the parent assess the noise in the environment. In addition to reducing background noise by turning off televisions, radios, and other electronic devices and machines, the parent can improve the child's auditory access by moving closer to the child. Reducing the distance from 6 feet to 3 feet increases the sound input to the child by 6 decibels (dB). Halving the distance again to 1 1/2 feet adds an additional 6 dB. Thus, sitting close to the child and being on the same level, perhaps side-by-side, can help improve auditory access. Ling refers to this as keeping the child "within earshot" (Ling, 1980).

Overhearing or Incidental Learning

Children with hearing loss should first learn to listen in optimal conditions where the signal-to-noise ratio is good and the distance from the adult's voice to the microphones of the child's hearing technology is fairly close. Once the child begins to learn to listen and attach linguistic meaning to the speech signal, listening confidence grows. Then, the child who is deaf or hard of hearing can perceive, discriminate, localize, and comprehend from greater distances than earshot (Ling, 1980). The goal is to help the child learn how to acquire spoken language through listening. To do this effectively, the child needs to learn the cues for redundancy: prosodic patterns, phonotactic probabilities, context of the conversation, word and world knowledge, and knowledge of the rules of syntax. Today, we expect many of these children to also demonstrate spontaneous learning without direct instruction. The typical child with normal hearing develops the ability to learn through overhearing. In fact, it is suggested that overhearing or incidental learning accounts for a substantial amount of world knowledge, vocabulary development, and social awareness. Learning through distance listening and overhearing is a desirable goal for the child who is deaf or hard of hearing to achieve (Beck & Flexer, 2011; Cole & Flexer, 2011).

Talk Time: Amount and Quality of Input

The most important sensory input that the child receives is spoken language. This helps to establish skills for entry into the social world of communication. Abundant spoken language input is needed for the child to develop adequate spoken language skills. This was demonstrated in a landmark study by Hart and Risley (1995), who did frequency counts of words heard by children. They found that children who heard more words spoken by adults in their environment had better vocabularies and IQ scores. This research has been corroborated by more recent studies using electronic recording and analysis devices (Oller et al., 2010; Zimmerman et al., 2009) and was the basis for the development of the LENA technology (LENA Foundation, http://www.lenafoundation.org).

LENA stands for Language Environment Analysis. The LENA system uses an automatic electronic recording device and computer analysis software to analyze the child's listening language environment. The software package provides reports on frequency of adult talk, frequency of conversational turns, child vocalizations, and amount of background noise in the child's language learning environment. It has been used in both home and school settings.

Because a child spends more time with the family than at intervention sessions, it is vital to encourage parents or caregivers to become knowledgeable and confident in how they talk, how much they talk, and what they talk about to their child. The LENA has become a clinical research tool that can provide information to parents about how much time they spend talking to their child, how many conversational turns the child takes, and their child's vocalizations. It can also report the amount of background noise, such as television or radio sound. Recent studies using the LENA system with young children with hearing loss indicate that the technology holds great promise for guiding parents in these key areas, so that the quality and quantity of auditory language input to the child can be increased (Morrison & Lew, 2012; Yoshinaga-Itano et al., 2011).

Hearing Age: Tracking Auditory Learning

A concept of **hearing age** or *listening age* is useful when working with children with hearing loss (Cole & Flexer, 2011; Cole & Paterson, 1984; Pollack et al., 1997). Hearing age is calculated from the date the child begins to consistently wear appropriate hearing technology. For example, if a child is 2 years old and began wearing hearing aids consistently at 3 months of age, then his functional hearing age would be 21 months. This child is not far behind and has a good chance of closing the gap between his or her hearing/listening age and his or her chronological age. A child of 3 years whose hearing loss was detected late and who did not start wearing hearing aids until 2 years old would have a hearing age of 1 year. At 2 years behind his chronological age, this child will have a more challenging time closing the gap between his or her hearing/listening age and chronological age. This calculation process can become complex if there are periods when the child does not have good auditory access to spoken language. This might be due to damaged or lost technology, poor earmolds, ear infections, deteriorating hearing thresholds, or reluctance of the child to wear the hearing technology (or the parent to put it on the child). In addition, if the child becomes a cochlear implant candidate, it is useful to calculate the amount of time of successful implant use with appropriately mapped implant(s), especially if the child did not have good access to the complete speech signal prior to receiving the implant.

The use of hearing age helps put into perspective the child's length of listening and how he or she is progressing. A child with normal hearing usually listens for about a year before first words emerge, so we need to give the child with hearing loss a sufficient amount of time to learn to listen. However, an older child (say 3 years old) with sufficient cognitive experience can accelerate learning once he or she knows how to listen and learning happens.

Auditory Hierarchies, Checklists, and Developmental Scales

In the past 20 years, universal newborn hearing screening with early detection of hearing loss, improved hearing technologies, the lowering of the age of cochlear implantation, and expectations of parents in choosing auditory–oral education options have all had an impact on the requisite knowledge and skills needed by professionals. Cochlear implants in particular have led to a surge in interest in using audition to develop spoken language. More and more professionals, cochlear implant and hearing aid manufacturers, and professional organizations have produced information related to auditory-based learning for children with hearing loss. Jointly written textbooks on auditory–verbal therapy (Estabrooks, 2012; Rhoades & Duncan, 2010), auditory models, hierarchies of auditory skills, checklists, and scales of development have appeared. Some focus purely on auditory skills, whereas others have information on additional areas of development. Although both types are helpful, it is essential for the professional who is providing intervention to be aware of the holistic development of each child and see how auditory skills are being acquired in relation to other areas of development. As we observe and document the progress of a child with hearing loss, it is important to view the whole child—not a set of ears in isolation (Boothroyd & Gatty, 2012).

A list of useful resources, including auditory hierarchies, checklists, and developmental scales, can be found in Appendix C at the end of this chapter. It is by no means an exhaustive list, but will give the reader some resources. The Auditory Skills Checklist by Anderson (2004) is available online and also printed by permission at the end of this chapter. Also available online is the Integrated Scales of Development by Cochlear Corporation (2009). In conjunction with other auditory measures, these can be useful when observing the child's listening behaviors to help guide both assessment and intervention.

Functional Auditory Assessment

The term **functional auditory assessment** has been used to describe a variety of parent and teacher reporting tools. Good summaries of these are available in Cole and Flexer (2011, pp. 164–165), from Tharpe & Flynn (2012, available from the Oticon website: www.oticon.com/~asset/cache.ashx?id=10835&type=14&format=web), and on Anderson's website (http://successforkidswithhearingloss.com/tests). For our purposes, we consider functional assessments of listening to encompass not only observational reports, but also diagnostic assessments of the child's listening skills on a variety of tasks.

Why do a functional listening assessment? Assessment is the basis for setting long- and short-term goals. It gives a baseline of performance and, when readministered, measures growth and the effectiveness of our intervention. It determines what we teach and, often, the order in which we teach it. An audiogram is limited in what it can tell us about how a child hears. It gives us information about the frequency and intensity of the child's hearing thresholds (both unaided and

aided), but does not tell us anything about durational cues or how sound is processed and interpreted. Two children with similar audiograms may differ greatly in their listening and speaking skills.

Many factors can impact listening and spoken language outcomes. Some of these are intrinsic to the child, such as cognitive ability, the presence of other disabilities, learning style, and ability of the brain to process speech and spoken language input. Extrinsic factors may include age at identification and intervention, appropriateness of hearing technology, consistent wearing of hearing technology, type and amount of intervention, and parental support. It is therefore often difficult to predict functional listening abilities from audiograms. We need to go beyond the audiogram to find out what the child can do in real-life situations outside of the audiology booth. Functional assessment of listening does not replace traditional audiological assessment, but can complement and help us determine the amount of carryover (Robbins, Svirsky, Osberger, & Pisoni, 1998). By evaluating how the child uses his or her hearing, we get a more complete picture of the child's abilities.

As with any type of assessment, professionals need to have a basic understanding of what we are assessing and why we are assessing it. Are we using the results to set goals, measure the effectiveness of our intervention, or establish eligibility for services? We need to be able to assess clients of different ages and abilities. We need to adapt assessments as needed and to select goals, teach, and then reassess. We also need to be able to interpret our assessment results and explain them to the family.

Assessments may be formal or informal. Most formal tests are available commercially, but do not underestimate the value of teacher-made assessments. Tests may be normed or criterion referenced. Due to the lack of current normed data for children with hearing loss, we are primarily using criterion-referenced tests, which assess the child's level of performance against his or her earlier scores. Tests may be subjective (such as parent reports) or objective, such as those based on observation or on having the child demonstrate specific tasks. It is usually instructive to have a variety of assessments and not base all information on one kind of assessment. For example, questionnaires are helpful, but we suggest that you confirm these impressions by observing what the child does and perhaps developing some informal diagnostic activities to assess his or her listening skills.

Rather than give an exhaustive list of tests, we will talk about types of tests and suggest some assessments we have used with success. Then we will provide some guidelines for creating your own assessments.

Questionnaires

Several questionnaires are available that fall into two categories: those for parents and those for teachers. Although parent reports are subjective, they can be an excellent starting point when assessing infants and very young children. They can also be useful with hard to test children. Teacher reports can give good insight into how the child functions in the classroom. The professional should be familiar with a few of these tools and how they can be used.

Two parent interview tools that we have found helpful are the Meaningful Auditory Integration Scale (MAIS; Robbins, Renshaw, & Berry, 1991) and the Infant–Toddler Meaningful Auditory Integration Scale (IT-MAIS; Zimmerman-Phillips, Osberger, & Robbins, 1997). These scales consist of 10 probe items designed to assess the young child's use of hearing, hearing technology, and early auditory skills. The MAIS was designed for children ages 3 and up and the IT-MAIS was later developed for children ages 0–3 years. The IT-MAIS is now available from Advanced Bionics online (http://c324175.r75.cf1.rackcdn.com/IT-MAS_20brochure_20_2.pdf). We have found that, because companies sometimes change where particular pages are located on their websites, it is often more efficient to find items by using a web search engine.

Another useful tool is *LittlEARS*: *Auditory Questionnaire Manual: Parent Questionnaire to Assess Auditory Behavior in Young Children* (Coninx, Weichbold, & Tsiakpini, 2003), which is available through Med-El.

A parent tool that guides the parent through observation of listening activities is the test of Early Listening Function (ELF, Anderson, 2002). This has the added advantage of assessing the young child's ability to hear a variety of speech and environmental sounds at different distances. It also looks at listening in quiet versus listening in noise, thus sensitizing the parent to the importance of the auditory environment.

Two tools useful for classroom teachers are the Screening Instrument for Targeting Educational Risk (SIFTER, Anderson, 1989) and the Preschool SIFTER (Anderson & Matkin, 1996). These each have 15 items that help the teacher identify which children may be at risk for educational failure. These and other assessment tools by Anderson are available for free from her website (http://successforkidswithhearingloss.com/tests).

Closed-Set Auditory Assessments

Closed-set assessments have a fixed number of stimuli from which the child chooses the correct answer. For example, the child may have a set of four objects or picture cards

from which to choose—a ball, a cookie, a hotdog, and a hamburger. The examiner presents the word through audition only, such as "cookie," and the child must select the correct item. In our experience, it is highly advantageous to have the child repeat the word (or an approximation) before selecting the item. This helps the tester to determine whether the child is selecting what he or she actually heard or is just picking a favored item. Two well-known assessments used in closed-set tasks are the Early Speech Perception Test (ESP), which uses pictures, and the Low-Verbal ESP, which uses objects (Moog & Geers, 1990). These are both word-level tests, but phrase- and sentence-level assessments can be constructed for using written sentences (for students who are readers) or pictures.

Open-Set Auditory Assessments

Open-set assessments are tests for which there are no materials—the items on the test are unknown to the child. This is a more difficult assessment, because the child does not have a group of items from which to choose. The set can be limitless; however, it is important to remember that the items need to be within the child's receptive language vocabulary. The Glendonald Auditory Screening Procedure (GASP) has a word-level test of 12 words and a sentence-level series of 10 questions (Erber, 1982). Both the GASP words and GASP sentences are straightforward and do not take very long to administer or score. They may need to be adapted for young children.

A useful assessment for older students is *Auditory Rehabilitation: Memory, Language, Comprehension Test Probes* (Stefanakos & Prater, 1982). Originally designed for hearing individuals, we find this a very good assessment for children ages 10 and older who are placed in regular education classrooms. It begins with having the evaluator read one sentence and assessing the child's ability to answer one fact-based question based on the information provided in the sentence. The probes increase in length and complexity until the examiner is reading a short paragraph and asking five fact-based and two inference questions. Many of the passages contain new or unknown information/vocabulary, so it is a worthwhile assessment of whether the child can process (and remember) new information.

Comprehensive Assessments

A test that assesses a wide range of auditory abilities is the Auditory Perception Test for the Hearing-Impaired (APT/HI-R) (Allen, 2008). Designed for ages 3 and older, the test begins at a basic level of sound detection and progresses through 16 skill areas of discrimination tasks, identification, comprehension with a picture prompt, and, finally, open-set auditory comprehension (similar to the GASP sentences). Skills are assessed in auditory plus visual versus auditory-only presentations, and results are reported on a student profile. This profile is a visual representation of the student's auditory functioning on each of the auditory skills assessed. Comparison of the auditory plus visual and the auditory-only profiles over time are useful for documenting student progress (Rosa-Lugo & Allen, 2011).

Practical Application: Developing Your Own Assessments

Auditory learning is a dynamic process, and therefore assessment at various levels is needed. Children who are deaf or hard of hearing are a heterogeneous population; in other words, no two children are alike. It is necessary to gear your selection of assessments toward the individual child and his or her particular abilities. Once a professional understands the rationale behind the various assessments, it is possible to construct assessments that meet the needs of each child. This can be particularly useful when assessments need to be adapted or constructed for students with hearing loss and additional challenges or those with linguistic or cultural differences.

For example, if you were working with a 2 1/2-year-old child with limited vocabulary, you would need to select items that would be in the child's listening vocabulary. Your instinct might be to use picture cards and have the child point, but it would be better to use three-dimensional objects or toys, because they will be more engaging and can be used in a more informal way. **Table 12.6** provides an example of words that differ in number of syllables (pattern perception), two-syllable spondee words with equal stress, and three-syllable words that you might use in such an auditory task.

For a young child with very little vocabulary, you might use sound–object or sound–action associations, often called the "learning to listen" sounds (Estabrooks & Birkenshaw-Fleming, 2006; Rhoades, 2000). These usually include animal and vehicle sounds and emphasize different suprasegmental features of speech. They should be done with toys in an informal play situation to see what the child can select from a small set of choices. **Table 12.7** provides an example of how these might be organized for an informal auditory-only assessment.

For an open-set word test, again, you should be guided by the child's vocabulary. **Table 12.8** lists some words you might use with a young preschool-aged child with hearing

Table 12.6 A Closed-Set Auditory Task

Pattern Perception	Spondees	Monosyllables
Ball	Hotdog	Ball
Cookie	Airplane	Book
Hotdog	Toothbrush	Bird
Hamburger	Bathtub	Boat
Total Correct		

Vary order of presentation within each column.

Table 12.7 A Closed-Set Auditory Task Using Learning to Listen Sounds

Pattern Perception	Two Syllables	Single, Extended Sounds
moo	quack-quack	mmm >>>
oink-oink	oink-oink	ah >>>>
hop-hop-hop	beep-beep	oo >>>
Total Correct		

Vary order of presentation within each column.

Table 12.8 Open-Set Auditory Tasks for a Young Child with Hearing Loss

GASP WORDS

(vary order of presentation)

One Syllable	Two-Syllable Trochees (Unequal Stress)	Two-Syllable Spondees (Equal Stress)	Three Syllables
Shoe	Water	Airplane	Butterfly
Fish	Table	Popcorn	Elephant
Ball	Pencil	Toothbrush	Santa Claus

Total Correct:_____/12

Sample Auditory Assessment for Open-Set Words

Child's Name _____ C.A. _____ H.A. _____ Date _____

(vary order of presentation)

One Syllable	Two-Syllable Trochees (Unequal Stress)	Two-Syllable Spondees (Equal Stress)	Three Syllables
Shoe	Cookie	Backpack	Hamburger
Fish	Baby	Hotdog	Elephant
Ball	Pencil	Bathtub	Santa Claus

Total Correct:_____/12

Blank Table for My Own Words

Child's Name _____ C.A. _____ H.A. _____ Date _____

(vary order of presentation)

One Syllable	Two-Syllable Trochees (Unequal Stress)	Two-Syllable Spondees (Equal Stress)	Three Syllables

Total Correct:_____/12

Adapted from Erber, N. (1982). Auditory Training. Washington DC: Alexander Graham Bell Association.

loss. First, we have presented Erber's word list from the GASP (1982), then our own words (based on a fictitious child), and, finally, left a blank table for you to use for creating your own words. Remember to vary the order of presentation of the words (don't just read down or across the list) and to give the assessment through audition alone with no visual or context cues.

This has been only a sampling of functional listening assessments and how you might also develop your own auditory assessments. Ongoing diagnostic assessment and intervention is an integral part of listening and spoken language programs.

Summary

Speech pathologists and teachers of the deaf/hard of hearing play a critical role on the team with audiologists and other professionals. They need to be able to interpret results from the audiologist and be able to explain these results to parents. In addition, they should assess the functional listening skills of the child and see how these results fit with the child's test results from the audiologist. An understanding of how auditory skills develop, how they are related to the development of spoken language, and how to observe and assess these skills is critical in order to lay the foundation for intervention. In conjunction with the parents, professionals should design an integrated program that incorporates acquisition of listening skills into the development of speech and spoken language.

When consistently using appropriate, current hearing technology, children with hearing loss have the opportunity to process spoken language through hearing. However, intensive auditory stimulation may be necessary for them to attain the listening and speaking skills commensurate with typically developing peers. Much depends on the ability of professionals and support personnel to monitor hearing technology, report any changes in hearing or suspected technology issues to the audiologist, optimize the child's auditory access to the speech signal, and provide effective assessment and intervention that supports use and carryover of listening and spoken language skills to everyday, real-life communication.

As speech and hearing professionals, we are part of a collaborative team approach, seeking to develop the most effective interventions possible. The coordination of assessment and intervention among team members is critical to the child's progress and the success of his or her educational program. Our goals for intervention need to be grounded in our understanding of how typical children develop and founded on our assessments and observations of individual child behaviors. Intervention must be based on the most current information available on the child's performance—in other words, it is goal driven. In this process, we need to be asking the right questions.

Assessment and intervention that puts the emphasis on speech production, without addressing underlying auditory abilities, reduces our effectiveness as professionals and compromises the abilities of our students to succeed. An approach that answers these questions and puts appropriate emphasis on optimal auditory access for the development of listening and spoken language development makes our intervention evidence-based and yields the most likely path to success for the child. In addition, approaches that focus on the integration of listening, speech, and spoken language, rather than on isolated auditory training, will be more beneficial in the long-term.

In this chapter, we have given an overview of auditory development in typically developing children and discussed some important issues relative to the child who is deaf or hard of hearing. We have presented a framework for assessment and intervention and discussed various functional listening assessments. The next crucial step is how to plan and implement intervention for the child who is deaf or hard of hearing. The reader is encouraged to use more than just this resource when providing auditory interventions in a therapeutic setting. There are several tools and resources available, including curricula and free online materials designed for children with hearing loss, which are presented in the appendixes at the end of the chapter. We hope that these can guide you toward acquiring the knowledge and skills necessary to support children in developing listening and spoken language skills for meaningful communication.

Discussion Questions

1. Why is it important to understand how auditory skills develop in typically developing children with normal hearing?
2. What is the relationship between listening and spoken language?
3. What elements need to be in place for a child with hearing loss to learn language through audition?
4. What is the concept of "hearing/listening age," and why is it important?
5. Discuss ways to ensure a beneficial auditory environment for learning through listening.
6. Discuss the four levels of auditory skill development proposed by Hirsh. How might they guide assessment and intervention?
7. What is the rationale for conducting a diagnostic, functional listening assessment with a child who is deaf or hard of hearing?

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Appendix 12-A: Auditory Learning Guide

Introduction

The ALG is a ***guide***- a hierarchical list of auditory behaviors, intended to provide professionals with:

- a **"roadmap"** through the development of a listening function
- a tool to help the child achieve an **optimal** rate of auditory learning
- a tool to help the child become a **confident** listener
- a tool that can help a child function with greater ease in a hearing environment.

It is *not* an exhaustive list of skills a child must master, step-by-step, in order to develop a complete listening function. Some of the behaviors are self-explanatory and some require further information, typically obtained when the ALG is presented in a workshop.

The ALG is in "all in one" chart form, rather than in a series of lists, so the professional (and parents) can see each auditory behavior as part of the "big picture" in auditory learning rather than focus on each separate auditory skill. The color-coding gives a "ball-park" idea about timelines for auditory learning. As professionals become more skilled, children are likely to move faster through timelines. Children with more hearing may move faster. Children who are implanted at later ages may move faster through some steps due to increased attention span.

The guide includes five areas, or *levels,* listed across the top of the page (Sound Awareness, Phoneme Level, Discourse Level, etc.). Each level has one or more *steps*. Having all the levels on one chart rather than as separate lists, helps to communicate visually that several **areas of auditory development occur concurrently** for children who are deaf/hh, in the same way as they do for hearing children. The layout also reinforces the need to plan for auditory learning at several different levels, rather than to master one level before going onto the next.

Auditory Learning Guide

SOUND AWARENESS (Speech and Environmental Sounds)	PHONEME LEVEL** (Speech Babble)	DISCOURSE LEVEL (Auditory Processing of Connected Speech)	SENTENCE LEVEL	WORD LEVEL
Step 1 - Detect * the presence of any speech syllable.	**Step 1** - Imitate physical actions (before speech imitations).	**Step 1a** - Imitate motions of nursery rhymes/songs with accompanying vocalization.	**Step 1** - Identify familiar stereotypic phrases or sentences.	**Step 1a** - Identify and imitate approximations of "Learning To Listen" sounds varying in suprasegmentals and vowel content, e.g., (a-a-a)/*airplane*, (u)-(u)/*train*, (oi) (oi) *pig* in isolation, at the end, and then in the middle of a sentence.
Step 2 - Detect* vowel variety, [u] [a] [I] and raspberries [b-r-r]	**Step 2** - Imitate any phoneme that child produces spontaneously when given hand cue (or other cue).	**Step 1b** - Identify nursery rhymes or songs.	**Step 2** - Recall two critical elements in a message.	**Step 1b** - Identify one, two, and three syllable words in isolation, e.g., *cat* vs. *chicken* vs. *kangaroo*.
Step 3 - Detect* consonant variety, e.g., [m-m-m], [b^] [b^] [b^] and [wa] [wa]	**Step 3** - Imitate varying suprasegmental qualities in phonemes (vary intensity, duration, and pitch) aeeee (long) vs [ae ae] (pulsed); [ae-ae] loud/quiet/whispered; [ae] high/mid/low pitch.	**Step 2** - Answer common questions with abundant contextual support, e.g., "What's that?", "Where's mama?", "What is _____doing?"	**Step 3** - Recall three critical elements in a message.	**Step 2** - Identify words having the same number of syllables but different vowels/diphthongs and consonants, e.g., *horse* vs. *cow* vs. *sheep*.
Step 4 - Detect* the presence of environmental sounds at loud, medium, and soft levels at close range, at a distance of 6–12 ft. and at a distance of greater than 12 ft.	**Step 4** - Imitate vowel and diphthong variety, e.g., [u], [ae], [au], [i], etc.	**Step 3** - Identify a picture that corresponds to a story phrase in a three or four scene-story.	**Step 4** - Complete known linguistic messages from a closed set (ex: nursery rhymes, songs, familiar stories).	**Step 3a** - Identify words in which the ***initial*** consonants are the same but the vowels and final consonants are different, e.g., *ball* vs. *bike*.
Step 5 - Detect* whispered [hae] [hae] and [p] [p] [p]	**Step 5** - Imitate alternated vowels and diphthongs, e.g., [a-u] [e-I] [a-I]	**Step 4** - Identify an object from several related descriptors (closed set).	**Step 5** - Answer common questions about a disclosed and familiar topic: a) without pictorial cues; (b) over the telephone c) on audio/videorecording.	**Step 3b** - Identify words in which the ***final*** consonants are the same but the vowels and initial consonants are different, e.g., *food* vs. *card*.
Step 6 - Detect* the sounds of the Six Sound Test.	**Step 6** - Imitate consonants varying in manner (fricatives, nasals, and plosives). Use phonemes previously produced, e.g., /h/ vs. /m-m-m/ vs. /p/.	**Step 5** - Follow a conversation with the topic disclosed.	**Step 6** - Recall four or more critical elements in a message to follow multiple element directions.	**Step 4** - Identify words in which the initial and final consonants are identical but the vowels/diphthongs are different, e.g., *book* vs. *back*.
Step 7 - Detect* the sounds of the Six Sound Test at various distances.	**Step 7** - Imitate consonants differing in voiced vs. unvoiced cues, e.g., [b^] [b^] vs. [p] [p] and then with vowel variety, [bobo] [pae-pae]	**Step 6a** - Answer questions about a story with the topic disclosed.	**Step 7** - Complete known linguistic messages (open set).	**Step 5a** - Identify words in which the vowels & final consonants are identical but the ***initial*** consonants differ by three features - manner, place of articulation, and voicing, e.g., *mouse* vs. *house*.
Step 8 - Locate the direction of sound if amplified binaurally.	**Step 8** - Alternate consonants varying in place cues, first with varying vowels, e.g., /ma-ma/ /no-no/; /go-go/ bi-bi/, etc.	**Step 6b** - Answer questions about a story with the topic disclosed; story is teacher-recorded.	**Step 8** - Follow open set directions and instructions (disclosed).	**Step 5b** - Identify words in which the vowels & initial consonants are identical but the ***final*** consonants differ by three features - manner, place of articulation, and voicing, e.g., *comb* vs. *coat*.

Step 9 - Alternate syllables with varying consonants and same vowel, e.g., [bi], [di], [ho] [go]	**Step 7** - Recall details of a story (topic disclosed).	**Step 9** - Recall specific elements in a sentence by answering questions about an undisclosed but familiar topic.	**Step 6** - Identify words in which the vowels and the final/initial consonants are identical but the initial/final consonants differ by two features: (a) manner and place (voicing in common), *moat* vs. *goat*; (b) manner and voicing (place in common), *man* vs. *pan*; (c) place and voicing (manner in common), *boat* vs. *coat*.
	Step 8 - Sequence the events of a story (topic disclosed).	**Step 10** - Repeat each word in a sentence exactly. a.) predictable sentences "I'm going to the grocery store to buy cereal and milk." b.) less predictable sentences "A woman hit me so I told her to calm down."	**Step 7a** - Identify words in which the vowels and final consonants are identical but the ***initial*** consonants differ by only one feature - manner of articulation, e.g., *ball* vs. *mall*.
	Step 9 - Retell a story with the topic disclosed, recalling all the details in sequence.	**Step 11** - Recall specific elements in a sentence by answering questions on an undisclosed topic.	**Step 7b** - Identify words in which the vowels and initial consonants are identical but the *final* consonants differ by only one feature - manner of articulation, e.g., *cloud* vs. *clown*.
	Step 10 - Make identification based on several related descriptors (open set).		**Step 8a** - Identify words in which the vowels and final consonants are identical but the ***initial*** consonants differ by only one feature - voicing, e.g., *coat* vs. *goat*.
	Step 11 - Follow a conversation of an undisclosed topic.		**Step 8b** - Identify words in which the vowels and initial consonants are identical but the ***final*** consonants differ by only one feature - voicing, e.g., *bag* vs. *back*.
	Step 12 - Retell a story about an undisclosed topic, recalling as many details as possible.		**Step 9a** - Identify words in which the vowels and final consonants are identical but the initial consonants differ by only one feature - place of articulation, e.g. *bun* vs. *gun*.
	Step 13 - Process information in noise and at various distances.		**Step 9b -** Identify words in which the vowels and initial consonants are identical but the ***final*** consonants differ by only one feature- place of articulation, e.g., *sheep* vs. *sheet*.
	Step 14 - Process group conversations.		

KEY

The color codes in the chart designate auditory behaviors to be mastered by the end of the specified year, given optimally fitted hearing devices.

YEAR 1
YEAR 2
YEAR 3
YEAR 4

This guide is intended to aid professionals in the *beginning* stages of learning an auditory-based approach. As professionals acquire more experience in auditory teaching, children should progress more rapidly.

The information on this chart was adapted from Judy Simser's article in the *Volta Review* (1993) (** items), from the Auditory Skills Program, New South Wales Department of School Education, from the Foreworks Auditory Skills Curriculum (1976, North Hollywood, CA), and from teacher input.

Notes:

* A detection response could include turning head, pointing to ear, clapping, dropping a toy in a container, etc.

Reference:

Simser, J.I. (1993). Auditory-verbal intervention: Infants and toddlers. *Volta Review* 95(3): 217–229.

Appendix 12-B: Auditory Skills Checklist

Child's Name:_____ **Birth Date:**_____ **Person Reviewing Skills:**_____

Dates Auditory Skills Reviewed:_____

Directions: Skills should be checked-off only if the child responds or has responded using auditory-only clues, without any visual information available. Although these skills are listed in a relatively typical order of development, it is common for children to increase in the depth of their development in previously acquired skills while learning skills at more advanced levels. Work on skills from one or two levels at a time. A child's rate of progression can depend on cognitive ability, the ability to attend for periods of time, vocabulary size, ability to point, etc. Every time you monitor auditory skill development, check off changes in the child's ability to respond or perform each skill that is being worked on. Estimates of percent of the time the child is seen to respond are approximations only based on the observation of the parents and others who regularly interact with the child. In subsequent reviews of the child's auditory skill development check off progress made (e.g., add check to E column if child is seen to begin to respond or demonstrate skill).

NOT PRESENT (0–10%) E = EMERGING (11–35%) I = INCONSISTENT (36–79%) A = ACQUIRED (80–100%)

E √	I √	A √	AUDITORY SKILL	EXAMPLE	APPROX DATE ACQUIRED
			LEVEL ONE		
			Child wears hearing aids or implant all waking hours	Hearing aids worn at all times except for naps and bathing.	
			Awareness to sound: Child nonverbally or verbally indicates the presence or absence of sound.	Child's eyes widen when she hears her mother's voice.	
			Attention to sound: Child listens to what he hears for at least a few seconds or longer.	Child pauses to listen to father's voice.	
			Searching for the source of sound: Child looks around, but does not necessarily find sound source.	Child glances or moves in search of the sound.	
			Auditory localization: Child turns to the source of sound.	Child turns to Mom when she calls her.	
			LEVEL TWO		
			Auditory feedback: Child uses what he hears of his own voice to modify his speech, so that it more closely matches a speech model.	Parent says ee-oh-ee and child imitates. Parent says woof-woof and child imitates	
			Auditory discrimination of nonlinguistic sounds and suprasegmental aspects of speech: Child perceives differences between sounds or sound qualities, such as loudness, long/short, pitch.	Child indicates which toys from 2 available made a loud sound;	
			Distance hearing: Child responds at increasing distances from the source of the sound.	Mother calls child from another room, and she hears her.	
			Auditory association of environmental, animal or vehicle sounds, and/or familiar person's voices.	Child identifies dog barking, points to the dog. Child hears Dad's car and smiles because she knows Dad is now home.	

E √	I √	A √	AUDITORY SKILL	EXAMPLE	APPROX DATE ACQUIRED
			LEVEL THREE		
			Auditory identification or association of different-sounding and familiar words and phrases – OBJECTS – closed set	Child has 3 favorite toys on the floor and gives one to the parent when it is named.	
			Auditory identification or association of different-sounding and familiar words and phrases – OBJECTS – open set	In the grocery store parent asks child to help find the apples.	
			Auditory identification or association of different-sounding and familiar words and phrases – COMMON PHRASES – closed set	Child responds by clapping when parent says "Patty Cake" (no motions) or raises arms when parent says "So Big!"	
			Auditory identification or association of different-sounding and familiar words and phrases - SIMPLE DIRECTIONS – closed set	Child is in getting dressed with clothes laid out; parent asks child to give her the socks.	
			LEVEL FOUR		
			Auditory identification or association of different-sounding and familiar words and phrases – COMMON PHRASES OR SIMPLE DIRECTIONS – open set	"Where's Daddy?" "Ow! My finger hurts!" "Give mommy a kiss!" Upon entering the bedroom, parent asks child to get his socks.	
			Discrimination of words on the basis of segmental features: indicate words with different vowels but the same initial or final consonants	Child can hear the difference between words like bat, bite, boat, bee	
			Conditional response to sound (if 18 month or older): Child conditions to respond to the presence of sound.	Child claps when he perceives any or all of Ling's sounds (oo, ah, ee, sh, s, m)	
			Discrimination of words on the basis of segmental features: indicate different manner of consonants but same vowels	Child can tell difference between words like see, knee, bee	
			LEVEL FIVE		
			Discrimination of words on the basis of segmental features: indicate same vowels, but consonants differ in voicing	Child can tell difference between sue-zoo; cap-cab; curl-girl	
			Discrimination of words on the basis of segmental features: indicate words with different manner and place of consonants but same vowel sound	Child can tell difference between words like hill, still, pill	
			Auditory recall: Child remembers groups of words that contain TWO CRITICAL ELEMENTS	Child is 'helping' to set the table and has big and little spoons and forks. Child can bring a big spoon to the parent.	
			Auditory recall: Child remembers groups of words that contain THREE CRITICAL ELEMENTS	Big red ball, little blue car, big red car, little blue ball	
			LEVEL SIX		
			Discrimination of words on the basis of segmental features: indicate same manner of consonants but different place of consonants	Child can tell difference between words like tea, pea, key	
			Auditory recall: Child remembers groups of words that contain FOUR CRITICAL ELEMENTS	Big dog with long black hair, little cat with short brown hair	
			Auditory sequencing digits: Child repeats several numbers or letters in correct order	Child repeats the model "3-6-2-4"	
			Auditory sequencing directions: Child carries out multipart directions	Put the kitty under the chair, the mommy in the car, and the bike by the tree	
			LEVEL SEVEN		
			Figure-ground discrimination: Child identifies and comprehends primary speaker from a background of noise or competing voices	Child hears and understands mom talking while music is playing	

E √	I √	A √	AUDITORY SKILL	EXAMPLE	APPROX DATE ACQUIRED
			Auditory recall: Child remembers groups of words that contain >FOUR CRITICAL ELEMENTS	Parent describes items in kitchen utensil drawer and child picks correct one	
			Auditory sequencing a story: Child retells story in correct sequence	Retell 3 Little Pigs or any other favorite story	
			Auditory blending: Child synthesizes isolated phonemes into words, or single words into sentences	Child blends the sounds h-a-t to produce the word 'hat'	
			LEVEL EIGHT		
			Auditory sequencing rhymes and songs: Child acts out and memorizes rhymes and songs	I'm a Little Teapot; Itsy Bitsy Spider	
			Identification based on several related descriptions and contextual clues, including expansion of vocabulary	Child participates in "description games" such as "I'm thinking of something that is red. It's a fragrant flower which grows on a bush. Its stem has thorns on it. People give them for Valentine's Day."	
			Auditory closure: Child understands and supplies the whole word or message when a part is missing	Child completes the statement: "Triangle, square, and rectangle are all _____". Or "snow is white, grass is _____"	
			Processing questions: Child answers thinking process questions	"What do you do when you're hungry?"	
			LEVEL NINE		
			Auditory analysis: Child processes phonemes, morphemes, and syntactic or semantic structures embedded in words and sentences.	Child related "-ed" to past tense in words. Child responds appropriately when an adult says, "Give me the shoe or the sock"	
			Auditory tracking: Child follows text as an adult reads aloud	Child moves finger over the pictures in a storybook as an adult reads the book.	
			Processing main ideas of stories and discussions	Child understands the main idea of a story. Child understands and participates in word, card, and board games. Child understands and participates in conversations.	
			Auditory comprehension: Listens and comprehends while engaged in another activity	Child listens to and understands a story while brushing his/her hair	
			LEVEL TEN		
			Auditory comprehension: Child understands relationship between verbal language and children's literature (story grammar)	Child relates to "Once upon a time," "lived happily every after," etc.	
			Auditory comprehension: Child carries on a conversation using auditory-only cues	Child carries on a conversation in the car or in the dark	
			Auditory comprehension: Child understands messages from electrical sound sources, such as tape recorders, videos/DVD, radio, etc	Child understands the words to a song on a tape recorder. Child understands the message from a school loudspeaker	
			Auditory comprehension: Child understands conversations on the telephone	Child talks to grandmother and is able to answer questions and discuss with her	

Reproduced from Anderson, Karen L. (2004). Auditory Skills Checklist. *Success for Kids with Hearing Loss; https://successforkidswithhearingloss.com/resources-for-professionals/early-intervention-for-children-with-hearing-loss*

Appendix 12-C: Resources

Christina Perigoe, PhD
Marietta M. Paterson, EdD

The following is a list of selected readings, auditory resources, CDs, videotapes/DVDs, and websites. This is not an exhaustive list, but it is a good starting place for parents and professionals interested in learning more about auditory development and about using listening to develop spoken language in children with hearing loss. It includes some older resources, so the reader may want to look at what has been incorporated into newer resources—especially those that are child- and family-centered. We have put an asterisk (*) next to those that are available for free on the Internet. Internet resources sometimes change their URL addresses, so it is a good practice to use a search engine to find the item.

Suggested Readings

Estabrooks, W. (1994). *Auditory-verbal therapy for parents and professionals*. Washington, DC: Alexander Graham Bell Association for the Deaf.

Estabrooks, W. (1998). *Cochlear implants for kids*. Washington, DC: Alexander Graham Bell Association for the Deaf.

Estabrooks, W. (Ed.). (2006). *Auditory-verbal therapy and practice*. Washington, DC: Alexander Graham Bell Association for the Deaf and Hard of Hearing.

Estabrooks, W., & Marlowe, J. (2002). *The baby is listening*. Washington, DC: Alexander Graham Bell Association for the Deaf and Hard of Hearing.

Ling, D. (1984). *Early intervention for hearing impaired children: Oral options*. Boston, MA: College-Hill Press.

*National Center for Hearing Assessment and Management & The Alexander Graham Bell Association for the Deaf and Hard of Hearing. (2012). *Early hearing detection and intervention programs: A blueprint for success*. Available from http://nc.agbell.org/Document.Doc?id=817.

Rossetti, L .M. (2001). *Communication intervention: Birth to three*. Albany, NY: Delmar.

Srinivasan, P. (1996). *Practical aural habilitation for speech-language pathologists and educators of hearing-impaired children*. Springfield, IL: Charles C. Thomas.

Talbot, P. (2002). *Topics in AV therapy: A selection of handouts*. Available from Acoustic Achievements, 16 Victory Street, Ronkonkoma, NY 11779. Also available from the First Years website: http://firstyears.org/c4/u3/talbotflyer.pdf.

Resource Guides and Teaching Materials

Alberg, J. (2010). *Understanding your child's hearing loss: A guide for parents.* Raleigh, NC: Beginnings. Available from https://www.ncbegin.org/index.php?option=com_rokquickcart&view=rokquickcart&Itemid=251.

Estabrooks, W. *Hear & listen! Talk & sing!* Washington, DC: Alexander Graham Bell Association for the Deaf and Hard of Hearing. Book and music CD. Available from the AG Bell bookstore: http://www.agbell.org.

Estabrooks, W. *Songs for listening, Songs for life*. Washington, DC: Alexander Graham Bell Association for the Deaf and Hard of Hearing. Book and music CD. Available from the AG Bell bookstore: http://www.agbell.org.

Hackett, L., & Rodriguez, L. (2004). *Comfort level checklist for auditory-verbal families.* San Antonio, TX: Sunshine Cottage for Deaf Children. Available from http://www.sunshinecottage.org/index.php/educational_products/our_products/comfort_level_checklist/.

Pepper, J., & Weitzman, E. (2004). *It takes two to talk: A practical guide for parents of children with language delays* (3rd ed.). Toronto, Canada: The Hanen Centre. Available from http://www.hanen.org/Guidebooks---DVDs/SLPs.aspx.

Sindrey, D. (1997). *Cochlear implants auditory training guidebook.* London, Ontario, Canada: Wordplay.

Sindrey, D. (1997). *Listening games for littles.* London, Ontario, Canada: Wordplay.

Sisson, M. (2008). *Workbook for parents of children who are newly identified as hard of hearing.* Available from Oticon Pediatrics, 580 Howard Avenue, Somerset, NJ 08873.

Auditory Assessments/Assessment Information

American Speech-Language Hearing Association (ASHA). *Directory of speech-language pathology assessment instruments*. Available from http://www.asha.org/assessments.aspx.

*Anderson, K. L. *Supporting success for children with hearing loss.* Available from https://successforkidswithhearingloss.com/resources-for-professionals/early-intervention-for-children-with-hearing-loss.

For assessments see http://successforkidswithhearingloss.com/tests.

Gallaudet University. *Suggested scales of development and assessment tools*. http://www.gallaudet.edu/Clerc_Center/Information_and_Resources/Cochlear_Implant_Education_Center/Resources/Suggested_Scales_of_Development_and_Assessment_Tools.html.

Auditory Checklists, Hierarchies, and Developmental Scales

*Alexander Graham Bell Association for the Deaf and Hard of Hearing. *Listening and spoken language knowledge center*. Available from http://www.listeningandspokenlanguage.org/Tertiary.aspx?id=1215.

*Cochlear Corporation. (2009). *The integrated scales of development. Listen, learn and talk*. Available from http://hope.cochlearamericas.com/reading-room/listen-learn-talk.

Estabrooks, W., & Marlowe, J. (2000). In *The baby is listening*. Washington, DC: Alexander Graham Bell Association for the Deaf and Hard of Hearing.

*Rhoades, E. *Auditory development scale: 0–6 years*. Available from http://www.auditoryverbaltraining.com/scale.htm.

*Simser, J. *Auditory-verbal techniques and hierarchies*. Available from http://auditory-verbalcommunicationcenter.blogspot.com/2011/06/auditory-verbal-techniques-and.html.

Sunshine Cottage School for Deaf Children. *Cottage acquisition scales for listening, language & speech (CASLLS)*. San Antonio, TX: Sunshine Cottage School for Deaf Children. Available from http://www.sunshinecottage.org/index.php/educational_products/our_products/caslls/.

*Walker, B. (2009). *Auditory learning guide (ALG)*. First Years: Professional Development Through Distance Education. Available from http://www.firstyears.org/c4/alg/alg.pdf.

Auditory Curriculum Guides

Auditory Skills Curriculum

Romanik, S. Moorebank, Australia: New South Wales Department of Education and Training. Originally developed in 1990, the revised edition (2008) includes placement test, manual, DVD, and CD with resource material. Available from http://www.schools.nsw.edu.au/media/downloads/schoolsweb/studentsupport/programs/disability/audskills.pdf.

Auditory Skills Curriculum, Auditory Skills Instructional Planning System (ASIPS)

Stein, D., Benner, G., Hoverstein, G., McGinnis, M., & Theis, T. (1976). Portland, OR: Foreworks. Available from http://www.foreworks.com/fore.html.

AuSpLan: Auditory Speech and Language: A Manual for Professionals Working with Children Who Have Cochlear Implants or Amplification

McClatchie, A., & Therres, M. (2003). Oakland, CA: Children's Hospital & Research Center. *Ausplan summary guide available from Advanced Bionics: http://www.advancedbionics.com/content/dam/ab/Global/en_ce/documents/libraries/AssessmentTools/3-01066-D-2_AuSPLan%20Supplement-FNL.pdf.

Learn to Talk Around the Clock—A Professional's Early Intervention Toolbox

Rossi, K. Washington, DC: Alexander Graham Bell Association for the Deaf and Hard of Hearing. Available from http://www.LearnToTalkAroundTheClock.com.

Listen Little Star: Family Activity Kit

Dornan, D. (2003). Brisbane, Australia. Available from Hear and Say: http://www.hearandsaycentre.com.au/ListenLittleStar.html.

Format: Year 1 activity book, program guide, and DVD

My Baby and Me: A Book About Teaching Your Child to Talk

Brooks, B. M. St. Louis, MO: Moog Center for Deaf Education. Available from http://www.moogcenter.org/Bookstorenbspnbspnbspnbspnbsp/tabid/149/Default.aspx.

Format: binder

Ski-HI Curriculum: Family-Centered Programming for Infants and Young Children with Hearing Loss (Revised)

Watkins, S. (Ed.). (2004). Logan, UT: Hope, SKI-HI Institute Utah State University. Available from http://hopepubl.com/products.php?cat=5.

**Sound Foundation for Babies*
Cochlear Corporation. Available from http://hope.cochlearamericas.com/node/2256.
Format: 40 online weekly lessons, songs, and rhymes
**Sound Foundations for Toddlers*
Cochlear Corporation. Available from http://hope.cochlearamericas.com/node/4410.
Format: 40 online weekly lessons, songs, and rhymes
Speech Perception Instructional Curriculum and Evaluation (SPICE)
Biedenstein, J., Davidson, L., & Moog, J. (1995). Available from http://www.cid.edu/ProfOutreachIntro/EducationalMaterials.aspx.
Format: Manual, rating forms, toys, cards, video, acoustic hoop *SPICE for Life*
West, J., & Manley, J. Available from: http://www.cid.edu/ProfOutreachIntro/EducationalMaterials.aspx. Format: Manual, resource book, CD, cards, tracking form
St. Gabriel's Curriculum for the Development of Audition, Language Speech, Cognition
Tuohy, J., Brown, J., & Mercer-Moseley, C. (2001). New South Wales, Australia: St. Gabriel's School for Hearing Impaired Children.
St. Gabriel's Curriculum and IEP Goal Writer. Available from http://www.hearandsaycentre.com.au/Cart/Professional_Education_and_Development/Training_Resources.aspx.

Videotapes/DVDs

ABCs of AVT. (Estabrooks, W.).Washington, DC: Alexander Graham Bell Association for the Deaf and Hard of Hearing.
The Baby Is Listening. (Estabrooks, W., & Marlowe, J.). Washington, DC: Alexander Graham Bell Association for the Deaf and Hard of Hearing.
Listen, Learn and Talk. Sydney, Australia: Cochlear Corporation.
Listen to This I & II. (Estabrooks, W.). Washington, DC: Alexander Graham Bell Association for the Deaf and Hard of Hearing.
What Professionals Need to Know for Cochlear Implant Rehabilitation. (Bader, J., Biever, A., & Tyabji, A. H.) 2006. Washington, DC: Alexander Graham Bell Association for the Deaf and Hard of Hearing.
* The following DVDs are all free for download or ordering from http://www.oraldeafed.org:
Hear the Difference
Make a Difference
Dreams Made Real
Dreams Spoken Here
Speaking for Myself

Internet Resources (Most are Free)

Advanced Bionics:

IT-MAIS: http://www.nationaldb.org/documents/IT-MAS_20brochure_20_2.pdf
Learning to Listen Sounds: http://www.hearingjourney.com/userfiles/File/1_05instr.pdf
Ling Six Sound Test: http://www.advancedbionics.com/us.en/support/tools_for_schools.html
The Listening Room (Hearing Journey): http://www.hearingjourney.com/index.cfm?langid=1

Alexander Graham Bell Association for the Deaf and Hard of Hearing: Listening and Spoken Language Knowledge Center: http://www.agbell.org
Auditory-Verbal Center (Atlanta): http://www.avchears.org
Auditory-Verbal Training (Ellen Rhoades): http://www.auditoryverbal-training.com
Beginnings (North Carolina): http://www.ncbegin.org

Cochlear Corporation:

HOPE online courses (free) http://hope.cochlearamericas.com/online-courses
Ling-6 Sounds: http://www.cochlear.com/files/assets/Ling-6%20sound%20test%20-%20how%20to.pdf
Ling-6 Sounds Flash Cards: http://www.cochlear.com/files/assets/Ling%20cards.pdf
Speech Sounds Guide: Consonants: http://professionals.cochlearamericas.com/sites/default/files/resources/Speech%20Sound%20Rehab._0.pdf
Speech Sounds: Vowels: http://hope.cochlearamericas.com/sites/default/files/resources/Speech-Sounds-Vowels.pdf
Sound Foundation for Babies: 40 online weekly lessons, songs and rhymes: http://hope.cochlearamericas.com/node/2256
Sound Foundations for Toddlers: 40 online weekly lessons, songs and rhymes: http://hope.cochlearamericas.com/node/4410

Deaf Children Can Speak: http://www.deafchildrencanspeak.com
Hear and Say (Brisbane, Australia): http://www.hearandsaycentre.com.au
Hear in Dallas: http://www.hearindallas.com
John Tracy Clinic (including parent support and resources in Spanish): http://www.johntracyclinic.org

Ling Six-Sound Test: http://www.jtc.org/uploads/docs/The-Ling-Six-Sound-Test.PDF
Ling Speech Cards: http://www.jtc.org/professionals/purchase-ling-speech-cards

Life Is Bliss (blog): http://ardinger.typepad.com/bliss/audio_verbal_therapy/
Listen and Talk: http://www.listentalk.org
Listen-Up Web: http://www.listen-up.org
Listening for Life (Joanna Stith): http://www.listeningforlife.com

Net Communications for Communication Disorders and Sciences (Judith Kuster): http://www.mnsu.edu/comdis/kuster2/welcome.html

Med-El: http://www.medel.com/us/index/index/id/1/title/HOME

Online comic book: Will Wonder and his Robot Ears: http://www.medel.com/data/willwonder/?PHPSESSID=v0u91v2cujk7fvt9334vk8pq80

My Baby's Hearing: Boys Town National Research Hospital: http://babyhearing.org

National Center for Hearing Assessment and Management (NCHAM): http://www.infanthearing.org

Natural Communication, Inc.: http://www.nciohio.com

Oral Deaf Education: http://www.oraldeafed.org

Sound-Object Associations (The Learning to Listen Sounds): http://www.listen-up.org/dnload/listen.pdf

Voice for Hearing Impaired Children (Canada): http://www.voiceofordeafkids.com

WE Listen International: http://welisteninternational.com