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DEAF AND HARD-OF-HEARING STUDENTS

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Introduction

In the 2016 edition of this chapter, the authors (Lomas, Andrews, and Shaw) describe the risk factors for deaf and hard-of-hearing individuals such as the deprivation of early communication and language which may cause delays in cognitive, socio-emotional, and behavioral growth often leading to social isolation, illiteracy, and challenging internalizing and/or externalizing behaviors. These factors combined with poverty can compound the deaf child's vulnerability for abuse, neglect, and maltreatment (Lomas & Johnson, 2012). During the revisions of this chapter, we (the new authors) agree that these risk factors warrant ongoing attention. We use our combined experiences as authors from three disciplines—behavioral health, deaf education, and school administration—coupled with select research findings to address these risk factors; summarize current research findings, best practices, and legal precedents; and suggest future research agendas needed to confront and reduce these risks.

Terminology Influencing Deaf Identity

Historically, the dominant hearing society has viewed deafness through a deficit model, labeling deaf people as "deaf and dumb," "deaf mute," and more recently "hearing impaired." Many of these terms imply that deaf individuals have lesser intelligence, cannot function in the broader hearing society, and are broken, perhaps needing to be fixed. These terms focus on what deaf or hard-of-hearing individuals cannot do, rather than solely identifying them as an individual with a different hearing status (i.e., level and range) than the broader population. National organizations and centers (e.g., National Association of the Deaf, National Deaf Center, Alexander Graham Bell) state on their websites and materials that d/Deaf or hard of hearing is the most respectable and preferred way to refer to individuals who belong to the deaf community. In this chapter, we use the term *deaf* to include all individuals who identify as deaf, Deaf, hard of hearing, deafblind, deafdisabled or any version of deafness that includes the diverse population of individuals that exist within the deaf community.

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Terminology in deaf education has historically been conceptualized by two paradigms: (a) The *socio-cultural-linguistic* view, which acknowledges deaf people have language (American Sign Language) and a culture of their own, compared to (b) the *medical-audiology* perspective, which is concerned with ear and hearing health, diagnostics, rehabilitation, development of speech and hearing, and auditory assistive technology. However, there are many factors that influence a deaf person's identity, thus creating the opportunity for individuals to experience intersectionality amongst the various ways they view themselves. For example, identity can be influenced by one or more socio-cultural-linguistic factors such as culture, ethnicity, family and educational experiences, presence of Deaf community supportive networks, communication and language preferences, and the use of auditory and visual technology. Terms such as *audism*, *racism, cultural genocide*, *auditory handicap*, *hearing impaired, hearing handicapped, deaf mute, deaf and dumb*, and even *prelingually deaf* have been eschewed by Deaf people adopting the socio-cultural-linguistic view. Visual artists such Betty Miller have expressed these feelings in the drawing of hands in slavery chains (Andrews & Lokensgard, 2010). Instead of these terms, Deaf people prefer more culturally empowering terminology such as the Deaf World (Lane, Hoffmeister, & Bahan, 1996), Deafhood (Ladd, 2003), Deaf Gain (Bauman & Murray, 2010), Deaf Ethnicity, People of the Eye (Lane et al., 2011), and intersectionality (Dunn & Anderson, 2020), terms that are a more accurate reflection of their identities and lives. It is important to realize that not all deaf people identify as "Deaf." This is not necessarily because they reject deaf culture, but because of psychosocial and/or familial reasons. Deaf people do not want to be defined according to what they cannot do (e.g., hear) but focus on what most can do—live productive and independent lives when given access to their language—American Sign Language—and to equitable education and employment (Leigh & Andrews, 2017).

Biological, medical-audiological factors such as gender, co-occurring disabilities, age of onset, extent of hearing loss, use of auditory technology, auditory factors and genetic background (Leigh, 2020; Leigh & Andrews, 2017; Leigh, 2009), and cultural considerations contribute to one's identity and how a deaf individual may be identified by those around them. The deaf community has a rich, vibrant Deaf culture with its own history, art, and literature (Leigh et al., 2018; Leigh & O'Brien, 2019). Due to historic oppression and stigmatization of deaf people, social protests have taken place to protect the places central to the deaf community. For example, the Deaf pride movement or the Deaf civil rights movement capitulated during the 1988 Deaf President Now (DPN) demonstrations. Subsequently, students and others rallied for the Deaf Unity protest of 2002, supporting a deaf president for Gallaudet University. Roberta (Bobbi) Cordano was inaugurated in January 2016 as the first female Deaf president of Gallaudet University—all of which signals a proactive stance (Leigh et al., 2018).

While culture is paramount, hearing science professionals such as otolaryngologists or ear-nose-throat doctors and audiologists are concerned with physiological issues that may affect an individual's short and long-term outcomes such as how one's hearing level can be permanent, fluctuating, progressive, or even temporary. Hearing loss can have an onset that is rapid or gradual and results in permanent progressive hearing loss either genetically caused, noise-induced, or a combination of both. A person can experience a sudden hearing loss with a traumatic brain injury, head trauma, or a virus (Northern & Downs, 2014). These professionals examine whether a hearing loss might be improved by surgery, medicine, or other medically based interventions, such as hearing technologies (e.g., hearing aids).

Audiologists examine an individual's hearing to produce an audiogram which determines if one's hearing loss is sensorineural, conductive, mixed, or a central hearing loss. Sensorineural losses are permanent and are caused by damage to the cochlea or inner ear. A conductive loss is often caused by chronic infections in the outer or middle ear, may be temporary or permanent, and can affect language acquisition and development. A child can have a central hearing loss caused by injury to the eighth auditory nerve up to the cortex. The audiogram also shows whether the hearing loss is unilateral, affecting one ear only, or bilateral, affecting both ears. The range of hearing is measured in both decibels (loudness) and frequency (pitch) and is graphically displayed on the audiogram through a range of categories: Typical/normal, mild, moderate, moderate-severe, severe, to profound hearing loss. The rate at which the hearing loss occurred within the deaf school-age population of learners during the 2011–2012 academic year (Gallaudet Research Institute [GRI], 2013) is reported in Table 18.1. What is paramount to understand and remember with this data is that any level of hearing loss can affect learning in a school environment.

By the nature of being deaf, individuals experience decreased incidental learning which can lead to deficits in background and world knowledge or what is generally called "fund of information" (Glickman, 2013). Deaf and hard-of-hearing people must overcome additional barriers in active and stimulating environments, such as having access to all aspects of what is happening in an active environment. For example, deaf children in a classroom with an interpreter will only learn what is interpreted. They are unlikely to catch side conversations, hear noises from the hallway, or hear traffic outside of the school and this affects learning in substantive ways, thus they may miss out on opportunities for incidental learning. They also rely

Table 18.1 Categories of Pure Tone Hearing Loss Levels (ASHA, 2009) and Percentages Found in School-Age Children (GRI, 2011)

Category	*PTA (Pure Tone Average)*	*Ability to Understand Speech*	*Percentage of School-Age Children within Category (GRI, 2011)*
Normal hearing	0 to 15 dB	Hears conversation normally	
Minimal hearing loss	16–25 dB	Hears vowel sounds but may miss some consonants (p, f, s, th)	20.8%
Mild hearing loss	26–40 dB	Hears only some speech sounds	13.7%
Moderate hearing loss	41–55 dB	Hears almost no speech sounds at typical speaking level	14.7%
Moderate severe hearing loss	56–70dB	Does not hear speech at typical speaking level	12.3%
Severe hearing loss	70–90 dB	Hears no speech and very limited environmental sounds such as lawn mowers, chain saws, motorcycles, rock bands, and other very loud sounds	12.9%
Profound hearing loss	91+ dB	Hears no speech and extremely limited environmental sounds (might detect sirens, firecrackers, and jack hammers)	25.7%

Data adapted from Brown (p. 935, 2009).

on the interpreter's language and interpreting skills, which may not always be up to par (Caselli, Hall, & Henner, 2020).

Professionals in the mental health field working with deaf people are increasingly attributing behavior challenges to having poor fund of information and language deprivation. Although a measurement of one's fund of information is impossible, it is clear that deaf signing children raised in environments that lack access to visual communication (American Sign Language) or deaf students who use hearing technologies and have compromised access to speech in listening and spoken language environments are both forced to make decisions with much less information than their hearing peers. A decreased fund of information and language deprivation may contribute to lack of knowledge about social mores, sexuality issues, impulse control, or problem-solving and decision-making abilities, thus leading to challenging behaviors at home, in school, in their communities, and within the criminal justice system (Lomas, 2021). Therefore, exposing deaf students to explicit rules, expectations, and implied behavioral norms is imperative to ensure their safety and understanding in all settings.

Prevalence

Prevalence data on hearing loss show that it occurs worldwide due to genetics, congenital viruses, infections, and environmental noise factors (e.g., machines, music, war explosions), causing permanent (sensorineural) or temporary (middle ear diseases and infections) hearing loss. Because no standardized international definition of hearing loss exists and countries collect data on the deaf population using different methods, it is challenging to get precise prevalence figures. An estimated 430 million people (432 million adults and 34 million children) have a hearing loss 35 dB or greater in the better ear (World Health Organization, n.d.).

Data from the Center for Hearing and Communication (CHC, 2021) show that there are 48 million people in the United States who have a hearing loss, 3 million of whom are children. The Center for Disease Control and Prevention (CDC) conducts annual surveys to collect data to inform the Early Hearing Detection and Intervention (EHDI) program (CDC, 2022). Data from the EHDI surveys report that approximately 1–5 children are identified with hearing loss per 1,000 births nationally. The 2019 CDC Hearing Screening and Follow-up Survey revealed that maternal education impacted whether an infant was screened for hearing loss, evaluated for a deaf or hard-of-hearing diagnosis, and subsequently enrolled in an early intervention program. In summary, mothers who had a college degree were more likely to follow through with screening (98.9%), diagnoses (75.8%), and early intervention (66.5%) compared to mothers who were high school graduates at screening (97.0%), diagnoses (50.8%), and early intervention (54.5%). Although maternal race does not affect infant screening, the data showed some disparities amongst maternal race and an infant's diagnosis and enrollment in early intervention. Mothers who reported their race as White or Asian were more likely to have their infant evaluated for a diagnosis (66.7%, 72.4%, respectively) and enroll them in early intervention programs (60.7%, 48.9%, respectively). Whereas mothers who reported their race as American Indian or Native Alaskan, Native Hawaiian or Pacific Islander, or Black were less likely to have their infant evaluated for a hearing loss diagnosis (39.7%, 48.0%, 33.5%, respectively) nor enroll their child in an early intervention program (38.0%, 46.4%, 47.4%, respectively). Clearly, professionals providing diagnosis evaluations and early intervention enrollment services need to create innovative ways to reduce the gap between maternal

education/race and these services. Diagnosis and early intervention are critical steps to ensuring all infants who are deaf have access to services that will mitigate potential developmental delays in all domains, particularly language, communication, and social skills. Beyond congenital factors that affect one's hearing, environmental factors may also cause hearing loss.

Noise causes 31.2 million Americans to have permanent, irreversible hearing loss. A breakdown of this population shows that 12.5% are individuals between the ages of 6–19 years old (approximately 5.2 million) and 17% are adults between the ages of 20–69 years old. These numbers continue to increase over time, given exposure to loud equipment (e.g., lawn mowers, snowmobiles, power tools, gunshots) and using earphones with loud volumes and prolonged usage (Byeon, 2021; National Institute on Deafness and Other Communication Disorders [NIDCD], 2021).

In 2017, the estimated number of individuals in the United States that identified themselves as culturally Deaf and who use American Sign Language (ASL) was 375,000 or 19% of the deaf population (Mitchell et al., 2006 cited in Leigh & Andrews, 2017). More recently, Mitchell and Young (2022) reported that approximately one million deaf and hard-of-hearing adults use sign language. Their data also shows that the unadjusted prevalence of adult sign language users who reported their hearing acuity at the "deaf," "a lot of trouble," and "moderate trouble" was approximated to be 522,000 (7.77%) of the total population of sign language users, both hearing and deaf) across the United States. The GRI (2013) reported that 15.2% of the school-age population receive instruction in sign language only, with 22.9% of family members using sign language regularly at home.

The school-age population of deaf learners is complex and unique. The rising number of English language learners in the United States is also reflected within the deaf population of K-12 students. Researchers reported that approximately 19–35% of the school-age deaf population come from homes where their caregivers or parents do not use American Sign Language nor speak English within the home setting (Cannon et al., 2016; GRI, 2013). Deafness may not be the only disability that individuals with hearing loss may experience. Research has shown that 40–50% of deaf school-age children have co-occurring disabilities such as autism, attention deficit disorders, learning disabilities, deafblindness, and intellectual disabilities (GRI, 1999–2011; Guardino, 2008, 2015; Guardino, Cannon & Paul, 2022). Understanding the etiology of deafness helps explain why the rate of coexisting factors is extremely high.

Causes or Etiologies

Approximately 38–42% of children who become deaf through viral infection or congenital syndromes also have cognitive, language, learning, emotional, neurological, or physical disabilities or a combination of these—all of which affect their development and school achievement (Leigh & Andrews, 2017). These co-occurrences are often the result of health complications and may not be directly related to hearing loss itself. Our understanding of etiologies can assist in developing future programs for children who are deaf with cognitive disabilities (Bruce et al., 2022; Luft, 2022; Vernon & Andrews, 1990), learning disabilities such as dyslexia (Cannon et al., 2022; Enns & Lafond, 2007), autism spectrum disorders (Borders et al., 2022; Vernon & Rhodes, 2009), deafblindness (Ingraham, 2007; Nelson et al., 2022), emotional and behavioral disorders (Cejas et al., 2022; Hamerdinger & Hill, 2005), and attention deficit hyperactivity disorder (Norman et al., 2022). Educational placement of learners who are deaf with disabilities is challenging and problematic because many public and state schools for the

deaf may not admit these students. Oftentimes, they do not have the specially trained staff nor the resources to handle youth who are deaf with psychiatric, emotional, psychosexual, and behavioral needs; thus, professionals are encouraged to form transdisciplinary teams to collaborate to determine the best placement and intervention strategies to use with these learners (Guardino & Cannon, 2022a, 2022b).

Nongenetic Causes

Cytomegalovirus (CMV), human immunodeficiency virus (HIV), rubella, syphilis, or toxoplasmosis are infections that cause sensorineural hearing loss (Bruce et al., 2022; CDC, 2020). CMV is the leading cause of nongenetic congenital hearing loss in infants and young children with other complications including microcephaly and intellectual disabilities. HIV is the virus that causes acquired immunodeficiency syndrome (AIDS) and can come with significant neurodevelopmental deficits (Stach, 2010). Bacterial infections or meningitis (inflammation or infection of the brain lining) can cause hearing loss as can other viral infections that occur with measles, mumps, and syphilis (Bruce et al., 2022). As shown in Table 18.2, these diseases affect deaf children's cognitive, social-emotional, language, and overall educational performance.

Table 18.2 Major Nongenetic Causes of Deafness

Etiology	*Description*	*Intelligence, Academic, Language, Physical, Behavioral Sequalae*
Birth trauma, low birth weight (prematurity)	Medical advances have raised survival rates of infants born premature, those who survive have multiple disabilities.	Low IQ, depressed academic achievement, profound hearing loss, cerebral palsy, aphasia, emotional disturbance, lower ratings for speech intelligibility, immaturity, brain damage, perceptual disabilities, unsatisfactory adjustment.
Meningitis	The leading postnatal cause of deafness among school age children. An infection of the membranes surrounding the brain, caused by bacteria, viruses, fungi, microbacteria, and spirochetes.	Low IQ. Those deafened after language acquisition do better in school. Have severe hearing losses. Typically few have more than one handicap. Secondary disabilities include aphasia, mental retardation, brain damage, and psychosis. May have delays in learning to walk due to damage of the vestibular system. Have inferior communication skills.
Maternal Rubella (German Measles)	Virus invades embryonic tissue and toxins circulate in developing fetus. Damages cells forming eyes, brain, ear and heart.	Low IQ, low academic achievement, presence of aphasia, behavioral disorders, high risk for diabetes and other endocrine disorders, additional physical problems.

(*Continued*)

Table 18.2 (Continued)

Etiology	*Description*	*Intelligence, Academic, Language, Physical, Behavioral Sequalae*
Cytomegalovirus	Viral infection transmitted in utero. Member of herpes family, carried by body fluids, including blood, saliva, breast milk, tears. Symptoms include high fever, chills, fatigue, headaches.	Can be accompanied by microcephaly (abnormally small head due to failure of brain to grow), mental retardation, developmental delays, coordination problems, central nervous damage, visual loss, and seizures.
Congenital Toxoplasmosis	Caused by a parasite infection contracted through contaminated food and animals, an infection transmitted from mother to fetus.	Vision problems, hydrocephaly, and mental retardation.
Erthroblastosis Felalis (Rh Factor)	Formerly a cause of deafness but now with medical advances such as Rh immunizations and prenatal transfusions, it is rare.	May involve central nervous damage, high prevalence of cerebral palsy, coordination problems, aphasia, academic disabilities, depressed IQ, and seizures.
Persistent pulmonary hypertension of the newborn (PPHN)	Infants' blood flow bypasses the lungs and eliminates oxygen support to the organs of the body.	Unknown
Syphilis	Venereal disease transmitted from mother to fetus.	Progressive hearing loss after two years of age.
Maternal diabetes, hypoxia, hyperbilirubinemia, ototoxic drugs, parental radiation	Maternal and infant ingesting of ototoxic drugs and chemotherapy treatments may cause infant hearing loss.	If the drug or chemotherapy occurs after language has been acquired, the child does better in academic and language areas. Drugs taken by mother during pregnancy can result in development problems for the infant. Drugs include otomyacins, accutane, dilantin, quinine, thalidomide.
Measles, encephalitis, chicken pox, influenza, mumps	Childhood diseases characterized by viral infections, rashes, fever.	More traumatic if diseases occur prior to age three before language is acquired.

Adapted from Vernon, 1969; Brown, 2009; Vernon & Andrews, 1990; Stach, 2010.

Genetic Causes

Genetic causes account for more than 50% of congenital deafness. Hereditary disorders can be dominant or recessive and result in either congenital hearing loss or progressive hearing loss later in life (GRI, 2011; Stach, 2010). Hereditary factors associated with hearing loss can be syndromic: Occurring with a group of other medical and physical disorders (30% of

deafness) or they can be nonsyndromic hearing loss, an autosomal dominant or recessive genetic condition with no other significant features than deafness (70% of deafness). Connexin 26 or GJB2 is the cause of 50% of nonsyndromic hearing loss (Bruce et al., 2022; Stach, 2010).

Syndromic Causes

With more than 400 syndromes accompanying hearing loss, genetic deafness is inherited in specific patterns that vary. Deafness can be present at birth (congenital), occurring prelingually (before language is acquired) or occur after birth, in early childhood postlingually (after language is acquired), in later childhood or adolescence, or even in the third or fourth decade of life. There are four inherited patterns: Autosomal dominant inheritance, autosomal recessive inheritance, x-linked recessive inheritance, and mitochondrial inheritance (Bruce et al., 2022; Stach, 2010; Vernon & Andrews, 1990). See Table 18.3 for a list of major genetic syndromic causes.

Table 18.3 Major Genetic Syndromes, Descriptions and Other Disabilities

Types	*Description*	*Other disabilities*
Alport syndrome	Caused by X-linked inheritance	Progressive kidney disease
Branchial-Oto-Renal Syndrome (BOR)	Autosomal disorder	Branchial clefts, fistulas, cysts, renal malformation
Cervico-ocolo-acoustic syndrome	Congential branchial arch syndrome occurring mostly in females	Fusion of two or more cervical vertebrae, retraction of eyeballs, lateral gaze weakness
CHARGE association	Five associated syndromes: C (coloboma), H (hearing disease), A (atresia choanae), R (retarded growth), G (genital hypoplasia), and E (ear anomalies.	coloboma (structural defect in the retina, iris, or other tissue of the eye), hearing disease, atreasia choanae (nasal cavity), retarded growth, and development and genital hypoplasia (failure to grow or develop), and ear anomalies
Jervell and Lange-Neilsen Syndrome	Autosomal recessive	Cardiovascular disorders, goiter disorders
Neurofibromatosis Type 2 (NF-2)	Autosomal dominant	Cochleovestibular and other intercranial tumors, disturbance in balance and walking, dizziness, tinnitus
Pendred Syndrome	Autosomal recessive	Endrocrine metabolism disorder, goiter disorders
Stickler-Syndrome (SS)	Autosomal recessive	Flattening of facial profile, cleft palate, vision problems, musculoskeletal and joint problems occurring over time, mitral valve prolapse

(*Continued*)

Table 18.3 (Continued)

Types	*Description*	*Other disabilities*
Treacher-Collins Syndrome	Dominant inherited	Conductive bone hearing loss, malformations of external ear, downward sloping of eyes, flat cheekbones, other facial features
Usher Syndrome	Autosomal recessive	Cause of deafblindness, progressive vision loss due to retinitis pigmentosa, three forms (Type 1, Type II and Type III)
Waardenburg Syndrome	Autosomal dominant	Lateral displacement of medial canthi, increased width of root of the nose, multicolored iris, white forelock

Source: Andrews et al., 2004; Vernon, 1969, Vernon & Andrews, 1990, Stach, 2010.

Identification

Today, Universal Newborn Hearing Screenings (UNHS) and other public health programs are part of a national Early Hearing Detection and Intervention system that is found in all 50 states, territories, and the District of Columbia with the National Center for Hearing Assessment and Management (NCHAM) managing data nationwide. Hearing screening for newborns differs from adults. Two common hearing screenings are auditory brainstem response (ABR) and otoacoustic emissions (OAE). ABR involves placing stickers on the infant's scalp/head and neck then placing small headphones or earmuffs over the ears. The technician or audiologist then emits soft sounds through the headphones to measure whether the pathway of sound from the auditory nerve to the brain is functioning properly. OAE takes place by inserting special earphones into the infant's ears and sending soft sounds through them to measure the functioning of the ear, rather than the auditory brainstem. ABRs are a more accurate measure of detecting hearing loss, however this test is more costly. The American Academy of Pediatrics (AAP, 2013) and the Joint Committee on Infant Hearing (JCIH, 2007, 2019) recommend a "1-3-6" model where children are tested using the UNHS before the age of one month, by the age of three months their hearing loss is confirmed, and by six months early intervention services have begun. The goal is for babies with hearing loss to be identified as early as possible so early intervention services can begin before the age of six months for the child and their family.

Quality early intervention consists of a team of individuals such as an audiologist, parent advisor/teacher of the deaf, speech-language pathologist, social worker or case manager, deaf adults/role models, physical therapists, occupational therapists, and trained professionals who can administer specialized assessments as needed. With the proper team and regular early intervention services, babies and toddlers who were identified as having hearing loss following the 1-3-6 rule can make better progress across all developmental domains: Language/communication, social, emotional, physical, and cognitive. (Fligor, 2015; Moeller, 2000; Yoshinaga-Itano et al., 2018, 2021).

A summary of the CDC EHDI data showed that although 98% of infants are now screened for hearing loss before leaving the hospital or birthing center, about one-third are "lost-to

follow-up" and do not receive diagnostic evaluations confirming or refuting their hearing loss by three months of age (CDC, 2020). Many of these children emerge into the educational system later, often qualifying for special education. Even if a baby passes the hearing screening, he or she may be at risk for hearing loss later in childhood, many of whom show up in special education classrooms because of delays in reading and language achievement (Northern & Downs, 2014).

Diagnosis

The 4–5% percent of parents who are deaf and have a deaf child typically welcome that child into the family. The other 96%—hearing parents—may experience their child's deafness as traumatic and stressful. They may go through periods of intense shock, disbelief, disappointment, grief, anger, and denial. They may "doctor shop" and seek folk or religious remedies. Parents often benefit from grief counseling whereby they can learn about hearing loss and deaf culture and work through their feelings so that they can bond and establish communication with their deaf child (Leigh & Andrews, 2017). After diagnosis, parents are provided with information on types of auditory hearing technologies (e.g. hearing aids or cochlear implants) and are typically referred to an early childhood educator who works with the family on choosing communication and language options. This information is sometimes overwhelming and confusing, as parents struggle to manage a new child, employment, and handling the demands of raising a child who is deaf. Unfortunately, many hearing parents never meet culturally Deaf people, nor do they learn that sign language can be a helpful bridge to spoken language during their search for information. EHDI guidelines support ~~the~~ families meeting Deaf mentors who can provide invaluable information about how sign language can support language development—both spoken and signed, even with children who use hearing technologies (JCIH, 2007, 2019; Leigh et al., 2018).

Hearing Technologies

Hearing technologies (e.g., cochlear implants and hearing aids) are advancing at a pace that has significantly changed the landscape of devices that parents may choose from as a means of communication for their child who is deaf. Advances in technology do not replace the need for support services for deaf students and adults. For example, a deaf person may need a sign language interpreter at school or during a college lecture (Marschark et al., 2006), a theater performance (Kilpatrick & Andrews, 2009), or during a courtroom trial (LaVigne & Vernon, 2003) regardless of the type of hearing technology they choose to use.

Cochlear implants have significantly affected how we provide intervention, early childhood services, education, family counseling, and audiological care and support. The NIDCD (2021) reported that as of 2019, approximately 750,000 cochlear implants have been implanted in individuals from infants to adults worldwide. More specifically, in the United States, over 118,000 cochlear implants have been implanted in adults and 65,000 in children. Since 2000, infants are eligible to be implanted beginning at 12 months of age. A cochlear implant is a prosthetic device that includes an external package made up of a microphone and a speech processor, and an internal package of an array of electrodes that are surgically implanted into the cochlea in the inner ear. The external and internal packages are connected through magnetic coupling. The cochlear implant bypasses the cochlea and stimulates the eighth auditory

nerve to provide a sensation of sound. Cochlear implants provide access to sound to many children who are deaf, and many have shown improvements in speech production, language, and reading (Pisoni et al., 2008; Yoshinaga-Itano et al., 2018). However, it is important to note that family support, resources for frequent mappings (every 6 months), batteries, maintenance, and regular speech therapy sessions are necessary for the success of the implant.

The success of cochlear implants for children varies widely depending on auditory memory, family support, age of implantation, resources of the family, nature, intensity and kind of speech therapy, and presence of additional disabilities (Christensen & Leigh, 2002; Yoshinaga-Itano et al., 2018). Most cochlear implant users will still need support such as sign language interpreters, note takers, deaf education teachers, tutors, and text-based captioning in class. Research from early intervention studies shows that when signs are introduced to babies with cochlear implants, vocabulary acquisition is accelerated. Speech skills "piggyback" on the child's sign language vocabulary (Yoshinaga-Itano, 2003; Yoshinaga-Itano et al., 2018). Other researchers have found that the brain has the capacity to learn two languages from birth. Results from brain imaging studies suggest that the brain can readily handle dual language development, bimodal and bilingually (Kovelman et al., 2009, 2014; Mertes, 2015).

Hearing aids have improved significantly over the past few decades. Advances in technology now make it possible for hearing aid users to access high-frequency sounds, which in turn improves access to language and one's ability to communicate. Digital hearing aids are "smart," allowing the user to control features (e.g., change volume, switch modes depending on environment, indicate the direction of a speaker or group of speakers, select different types of environments such as a classroom vs restaurant) of the aid(s) via an app on their phones, thus optimizing speech reception (Mertes, 2015). Users are able to pair their hearing aids with their music devices, phones, and televisions. Since the COVID-19 pandemic, some hearing aid companies have even provided features where the user can indicate if the person/people they are communicating with are wearing a mask (Starkey, 2022). The costs for hearing aids continue to be prohibitive for many individuals as they can run several thousand dollars for a pair and not all health insurance providers provide coverage.

Behavioral Characteristics

Throughout history, deaf people were thought of as less intelligent than hearing people and to be concrete rather than abstract thinkers (Moores, 2001). Today we know that intelligence is normally distributed in the deaf population and can express both concrete and abstract ideas. Examining intelligence functioning in a review of 50 studies, Vernon found that intelligence is normally distributed in the deaf population as it is in the hearing population (Vernon, 2005; Vernon & Andrews, 1990). In a meta-analysis of 285 studies that included 171,517 deaf children from 1900 to 1988, Braden (1994) found no significant difference in scores that compared nonverbal IQ scores that used norms for deaf children compared to studies that used norms developed for hearing children (Braden, 1994). One author of this chapter (Lomas) has performed hundreds of psychological evaluations with people who are deaf or hard of hearing and has found similar results. It should be noted that the deaf population is not homogeneous, and this may account for a great deal of variation in IQ scores. For example, schools often categorize all students with hearing loss as "Deaf" and do not identify additional special education eligibility categories. Deaf students may perform poorly on nonverbal IQ subtests

due to disabilities that are not accounted for in their academic profile. Zekveld et al. (2014) is one example among many subsequent studies that concluded there is no evidence that hearing loss lowers nonverbal IQ. The educational implications appear clear: Educational programs are needed for deaf students with a range of intellectual functioning from gifted to cognitively delayed. Like the general population, parents of deaf children are likely to seek placements that emphasize academic rigor. Deaf education programs that appear to lack rigor will lose enrollment of advanced students if high expectations are not established in all learning environments.

Cognitive Functioning

Cognitive abilities, both lower-level perception and attention and higher-level cognitive abilities that include cognition, thinking and language during memory, reasoning, and metacognitive tasks are intertwined. They continue to interact, build on each other, and evolve during the deaf child's mental development. These include visual attention, imagery, visual-spatial skills, memory, learning, and metacognition, to name a few. Deaf students' background and world knowledge, home and school experiences, language and communication modes, and their learning strategies play a part in this cognitive and learning development as well (Marschark & Wauters, 2011). Sign language may provide a path for deaf people to organize their thoughts, experiences, and perceptions of the world that may very well be different from non-signers. Knowledge of sign language influences visual perception, visual-spatial perception, motion, and the use of facial expressions (Emmorey, 2002).

Memory is tied to learning, including learning from the environment as well as academic learning, such as learning to read. Deaf children remember less than hearing children with numbers, printed words, and pictures, but they remember better with tasks such as recognizing faces and remembering paths of light arranged in space (Hamilton, 2011; Marschark & Wauters, 2011). Deaf children use both visual imagery in place of verbal codes and spatial coding to remember information. Although deaf students can use signs to remember printed words, images, and sign phrases, studies show they have to be explicitly taught these memory strategies (Hamilton, 2011). When reading, some deaf children use phonological memory codes while others use sign and fingerspelling encoding and coding strategies (Andrews & Wang, 2015). Even with better visual memory, deaf students still face challenges in learning subjects in the content areas, particularly finding relationships between cause and effect (Marschark & Wauters, 2011).

Other cognitive abilities include analytic reasoning and metacognition abilities, which include theory of mind (ToM) and executive functioning. Theory of mind is a psychological term meant to explain how people ascribe mental states to others, surmising what is happening in their mind. We use context clues, linguistic cues, and environmental feedback to determine how we react to situations, and ToM helps people better understand each other as we interact. ToM is important in building relational skills with peers and adults but may be compromised in some deaf children (Wellman & Peterson, 2013). When the language variable is controlled, deaf children are found to have better scores on these kinds of tasks, but still researchers are finding that the cognitive processes of deaf children may have some fundamental differences that are not yet fully understood or documented (Marschark et al., 2019; Smogorzewska et al., 2022; Supalla, Hauser, & Bavelier, 2014).

Social Cognition and Socialization

Infants are "socialized" as they learn turn-taking and vocabulary labeling routines from their mothers and caretakers. Longitudinal studies show that deaf and hearing mothers are able to set up these social and turn-taking routines visually and tactilely with their deaf infants (Koester & Lahti-Harper, 2010; Meadow-Orlans, Spencer & Koester, 2004). Children who are deaf who do not receive these visual and tactile interventions are at high risk for delays in language and social-emotional development, such as ToM. For example, deaf children are at risk of becoming socially immature, impulsive, egocentric and lack both reflectivity and responsibility for their actions. Additionally, deaf children with poor language may have deficits in their ability to empathize or predict or understand the feelings and motivations of others (Hamerdinger & Hill, 2005).

Another cognitive ability, Executive Functioning (EF), refers to a group of self-regulation skills that allow the person to focus attention, remember instructions, organize, control impulses, understand emotions (like ToM), and have the ability to problem solve, plan, and finish tasks. EF like ToM skills develop through early conversations between caregivers and their children about everyday activities. For example, a young child crying for a dessert may be held by his mother who tells the child he will get a treat later. This allows the child to learn that gratification can be delayed, and crying may not be helpful. Children who do not have early language are at risk for not developing ToM and EF skills (Meristo & Hjelmquist, 2009). Hintermair (2013) reviewed EF studies with deaf children and found a relationship between measures of social ability and EF skills. The researcher concluded that EF and communication competence reduce the chances of developing challenging behaviors.

Deaf children, like hearing children, can use language to increase thinking skills in tasks that include play, ToM, and executive functioning in their interactions. Studies show that deaf children with hearing mothers have similar play behaviors to hearing children with hearing mothers during early developmental stages with regard to motor behaviors. Musyoka (2015) found that deaf children who had deaf parents exhibited play behavior comparable to hearing children at the same age. Unfortunately, deaf children with hearing parents who do not provide accessible language are at risk of not reaching these milestones.

Communication and Language

Early and unfettered access to rich communication and language environments, whether it be ASL or a spoken language (such as English or Spanish) or a combination of these is critical. Communication refers to a symbolic system of gestures, vocalizations, mime, body language, and drawings. Language entails a rule-governed communication system based on linguistic principles. Somewhere in between language and communication are "home signs," which are invented signs and gestures that children who are deprived of sign language will naturally invent (Goldin-Meadow, 2003). These home signs are usually recognizable only to the child and those familiar with the child.

Recent work in psycholinguistics has posited that the infant's brain automatically learns language from the statistical regularities that exist in the stream of sounds or signs they are exposed to, and this process influences both phonetic learning (in signed or spoken words) and early word learning (Kuhl, 2015; Sandler & Lillo-Martin, 2006). In order to activate pattern

recognition (underlying language learning) in the brain, it becomes essential for the child to access social interactions (eye gaze, turn-taking; Kuhl, 2015).

Both deaf mothers and hearing mothers use eye gaze, vision, and touch to develop early communication and language. These eye gaze behaviors scaffold later joint attention, thus enabling the child to learn vocabulary and other aspects of language learning (Clark et al., 2015). Because the babies' brain is hardwired to look for statistical regularities or repetition of syllables in either signed or spoken words, this promotes language acquisition (Kuhl, 2015; Petitto et al., 2001). For deaf children, whether the language input is spoken, signed or both, timing is critical to language and cognitive development as well as mental and social well-being (Hall, 2017). Following the 1-3-6 model as recommended by the American Academy of Pediatrics and the Joint Committee of Infant Hearing, if intentional language and communication interventions are not established by six months or earlier, this can have an adverse and exponential effect on the child's eventual ability to acquire language and subsequent academic achievement (APP, 2013; JCIH, 2007, 2019).

In North America, for children who are deaf, there are two leading language choices: American Sign Language (ASL) or English (or Spanish as 28.5% of deaf children are from Spanish-speaking homes [GRI, 2011]). Deaf and hearing signers often mix the two languages into what may be referred to as contact signing (Lucas & Valli, 1992). For example, discrete ASL signs may be strung together into English syntax. This language-mixing phenomenon occurs among learners and speakers of multiple languages, even when a signed language comes in contact with a spoken language (Emmorey et al. 2015; Humphries et al., 2014).

American Sign Language (ASL)

First described using linguistic terminology by William C. Stokoe in 1960, ASL is a full-fledged language with its own grammar and vocabulary. Whereas English is a linear-sequential language, ASL is a visual-spatial-gestural language. Like English, ASL can also be analyzed at the sign, word, sentence, and discourse levels as both have a phonology, morphology, syntax, semantics, and discourse (Valli et al., 2011).

Deaf and hearing children of deaf parents often learn ASL from birth. For deaf children with deaf parents, it has been shown that the developmental milestones are similar to those expected of hearing children (Andrews et al., 2008). See Table 18.4. Exposing deaf children to ASL, given that this relies on eyesight over residual hearing and technology, helps guarantee full and complete access to language, which remains highly critical for cognitive and social-emotional development, as well as other domains (Hall, 2017).

ASL carries its own rich history of literature and storytelling elements. Deaf children who use sign language to communicate should be exposed to ASL literature, including poems and stories that are structured to play on the linguistic features of ASL (i.e., handshapes of signs, sign movements, etc.) to express meanings (Valli et al., 2011) and to improve their literacy. Unlike hearing children who learn their first language from their parents, deaf children who are born to hearing parents typically learn ASL from other deaf adults or hearing signers who they meet at schools and community events. Deaf people learn ASL on different timetables from early, middle, late childhood and even into adulthood (Newport, 1990). The first five years of life is when brain plasticity is at its highest; this is widely considered the critical period for language learning (regardless of language choice; Humphrey et al., 2012, 2014; Kovelman

Table 18.4 ASL, Speech, and Hearing Milestones

Age	*American Sign Language (ASL) Deaf Children of Deaf Parents*	*Speech Hearing Children of Hearing Parents*	*Hearing Hearing Children of Hearing Parents*
Birth to 1 year	Vocal babbling, manual babbling	Vocal babbling	Eye wide, eye blink, head turn, responds to changes in tone of voice, pays attention to music, plays peek-a-boo, listens when spoken to
1 to 2 years	Communication gestures, sign and shape errors, baby signs, first signs	Communication gestures, word errors, baby words, first words	Turns to sounds; points to body parts when asked; follows simple commands and understands simple questions; enjoys listening to simple stories, songs, and rhymes; points to pictures in a book when named
2 to 3 years	Two-sign sentences, correct pronouns, Wh- questions with facial expressions, verb agreement, some classifier handshapes, fingerspelling	Two-word sentences, word parts (articles, pronouns, verbs), conversations, Wh- questions	Turns to sounds; understands difference in meaning of "go/ stop," "in/on," "up/down"; follows two requests (e.g., get the book and put it on the table)
3 to 4 years	Topicalization and conditions, directional verbs, more fingerspelling	Consistent morphemes, irregular forms of verbs, simple sentences	Hears when someone calls from other room; hears TV or radio; understands simple questions asking who, what, when, where, why
4 years and older	Complex sentences, classifiers, more fingerspelling	Complex sentences, grammar development	Pays attention to a short story and answers simple questions about it, hears and understands most of what is said at home and in school

Source: Andrews, Logan & Phelan, 2008.

et al., 2014). For that reason, learning ASL (or any other language) past the critical period will result in language deprivation, leading to cognitive, academic, and social-emotional delays (Hall et al., 2019; Mayberry & Eichen, 1991).

Even though it does not require technology to learn, ASL continues to be used in a small minority of Pre-K through 12th grade deaf education programs, but it is gaining momentum as empirical data on the benefits continue to accumulate. Deaf students can be bilingual-

bimodal. They can learn and use both languages across academic and social settings: ASL and English depending on their conversational partners, language/mode preferences, and their educational background (Leigh & Andrews, 2017).

Fingerspelling

Fingerspelling is used in ASL as spelling is used in English; it is also seen as the bridge between ASL and English. Fingerspelling consists of 26 handshapes that represent 26 letters of the alphabet. Recent research from a linguistic standpoint has documented the complexity of fingerspelling from the linguistics standpoint and that it is not merely a manual representation of English orthography (Padden, 2006). It is also used for representing proper nouns or English words without a sign equivalent. Deaf children's early attempts at fingerspelling appear around 13 months of age, with the first fingerspelled words as young as two years of age (Erting et al., 2000; Schick, 2017). Deaf children do not pay attention to the individual handshape in the given fingerspelled word. Instead, they perceive fingerspelled words as whole units or signs.

Recent research is clear that fingerspelling, reading, and writing skills are intertwined and that these skills involve cognitive processes (Haptonstall-Nykaza & Schick, 2007; Lederberg et al., 2019; Easterbrooks et al., 2015). Padden and Hanson (2000) offer clues regarding automaticity and accuracy of word recognition, which are key capacities in reading fluency. They suggest that accuracy of word decoding—a key capacity in reading fluency—also plays a factor in comprehending fingerspelling. Deaf readers who are skilled in fingerspelling will also demonstrate greater fluency in reading due to shared underlying cognitive capacities involving word decoding accuracy and word recognition automaticity.

English

There are multiple pathways for deaf children to acquire English: Speech, spoken language, lipreading, speech reading, English-based signing systems, literacy (reading and writing), and/or fingerspelling. The majority of deaf children are exposed to and use all of these different modes of English throughout their lifespan. Educational programming, depending on the placement, may emphasize one or more of these modes to a greater or lesser extent. Families also make a large difference in the level of exposure to any and all of these modes in the home. Nonetheless, many deaf adults learn and use two languages—ASL and English—and will develop varying proficiencies in each of these languages. Some deaf individuals may become multilingual and learn other sign languages, especially those who immigrate to the United States for education or employment (Cannon et al., 2022; Wang et al., 2016).

Spoken Language, Speechreading or Lipreading

Deaf children must be taught spoken and written English through direct and explicit instruction, whereas most hearing children naturally and effortlessly acquire the skills of articulation, phonation, and respiration of spoken language. The spoken language of deaf and hard-of-hearing children is typically delayed compared to hearing children despite years of intensive speech training. Deaf children who have phonological awareness as well as adequate exposure to language may learn to speak as intelligibly as hearing peers, but many will not. Speech production abilities of deaf children with cochlear implants have shown increases in spoken

language by researchers and clinicians; however, there remains enormous variability in success rates and much depends on factors such as age of implantation, auditory memory, family support, and intensive postoperative speech therapy.

Lipreading or speechreading, which is the ability to visually recognize speech on the lips of the speaker, is sometimes seen as another method for deaf children to learn English. About 40% of English sounds can be visible on the mouth under good conditions (CDC, 2022), and factors such as eye fatigue, facial hair, lighting, foreign and regional accents make lipreading extremely difficult even for the person who already has learned English (Vernon & Andrews, 1990). Therefore, speechreading should not be considered a viable means of communication. It is also more challenging for young children to rely on this as a primary communication mode because they have yet to fully internalize the rules of English. Students and adults who are postlingually deaf have a better chance at lipreading because they already have an understanding of the spoken language (Vernon & Andrews, 1990). Deaf adults with cochlear implants do report advantages to lipreading, as visual speechreading helps with identifying sounds (Peterson, Pisoni, & Miyamoto, 2010).

Manual Representations of Spoken English

The grammar structures of English and American Sign Language (ASL) have been combined and blended for instructional purposes to make English grammar visible to deaf and hard-of-hearing students. Total communication (TC) was a term coined by Roy Holcomb, a Deaf man who was a school administrator of a large day program for deaf children. TC is a philosophy (not a method) initiated in the early 1970s. It consisted of auditory training, speech, speechreading, fingerspelling, ASL, English-based signing, gestures, art, written communication, and even pantomime (Holcomb, 2013). Simultaneous communication (SimCom) and sign supported speech (SSS) are pedagogical tools to teach English. Both SimCom and SSS combine the use of spoken language simultaneously with ASL, yet do not follow the linguistic rules of ASL. Thus, they are not considered languages even though all of these systems depend heavily on ASL vocabulary and deaf children using these sign language codes may also use facial expressions and a spatial grammar that are shared features of ASL (Leigh & Andrews, 2017).

In addition, there are manual codes of English that attempt to make English visible to deaf children by putting signs in English word order and inventing signs for verb tenses, morphological markers, articles, and other word endings (Paul, 2009). These include Signed English SEE1 (Seeing Essential English), SEE2 (Signing Exact English), CASE (Conceptually Accurate Signing English), and Linguistics of Visual English (LOVE). Of these systems, SEE2 is the most commonly used in schools (Leigh & Andrews, 2017). Definitions and video examples of these sign codes can be viewed on YouTube and the Internet. When signing is more ASL–like in grammar and contains the use of space, facial expressions, head tilts, eye gazes, and body movements, it is termed contact signing (Valli & Lucas, 2000). Most deaf adults communicating with hearing persons use contact signing. The amount of English and ASL in contact signing is dependent on the deaf person who is using it and to their conversational partner (see Paul, 2009 for a complete description of these sign codes).

Reviews of research have shown that these sign codes are better than monolingual approaches or speech alone, but not in the area of reading as achievement scores have been disappointing (Johnson et al., 1989; Lederberg et al., 2013). Challenges with these sign codes have been

noted. For example, the codes mix the two languages (ASL and English) so the child does not get a full representation of either language. In addition, teachers often drop morphemic endings and markers so the child does not "see" these grammatical forms (Paul, 2009). However, current studies in bimodalism are rethinking the combining of speech and signs and viewing it as a language resource rather than a negative language practice based on studies that show that many deaf children will naturally mix the languages, as well as case studies of deaf students whose teachers use code mixing to meet the communication and language needs of individual students (Plaza-Pust, 2014; Swanwick, 2015). The implementation of TC and SimCom resulted in a failure to provide complete grammar for either signed or spoken languages. Given bilingual language learning theory (Baker, 2011), this code mixing has not been found to provide the statistical regularities that are necessary to establish the neurological structures that facilitate the most effective linguistic processing (Kuhl & Rivera-Gaxiola, 2008). It is sometimes argued that parents find it easier to learn English-based sign systems rather than ASL. However, recent studies show that deaf children are especially vulnerable if they do not gain a full language during the critical acquisition period, and so the linguistic input must be guaranteed to be fully accessible (Hall et al., 2019).

Cued Speech is another English-based visual approach which uses handshapes placed in positions around the side of the face, mouth, and chin. The handshapes along with their positions create visual signals for English sounds for deaf children (Cornett, 1967), which provides deaf learners with visual access to all the spoken language. This can emerge as an advantage during literacy lessons where the emphasis may be on phonological awareness or other elements of the spoken language. Cued Speech may also be modified for use across other spoken languages such as Hebrew or Spanish. Studies by LaSasso and Crain (2015) show that Cued Speech aids in reading as it provides deaf children with a visual representation of the auditory phonological code. Cued Speech has grown in popularity over the past three decades, with Cued Speech transliterators becoming more commonplace in specific regions. There are many resources on the Internet that offer more information on Cued Speech, including the National Cued Speech Association.

Literacy

Literacy, the ability to read and write, is a measure of academic achievement in deaf children. Literacy also creates a tool for deaf individuals to communicate directly with hearing persons. Literacy is helpful across a variety of settings: Social, functional, academic, and vocational. Deaf children and adults, like their hearing counterparts, may vary widely on their English literacy abilities, with skills ranging from an illiterate deaf person to those who have advanced and sophisticated literacy skills. A commonly quoted statistic in deaf education is that the average performance on tests of reading and writing comprehension for high school graduates who are deaf and hard of hearing is at the third- or fourth-grade level (Qi & Mitchell, 2011). Language functioning precedes academic achievement, and generally deaf individuals with stronger language profiles have higher academic functioning.

Approximately 60% of deaf students graduate from high school and read at an average of the fourth-grade level (Qi & Mitchell, 2011). Reading and writing may be difficult for deaf learners for several reasons. Reading is matching speech sounds with print and involves a complex set of skills involving perception (looking at the text), cognition (i.e., logical reasoning,

background knowledge, knowledge of concepts, memory), social skills (i.e., ToM), and language skills (i.e., phonology, semantics, syntax, and pragmatics or discourse). Children who are deaf, without access to the phonological component of spoken language, and/or without a strong language foundation in ASL, often experience difficulty learning new words, and this is a major obstacle when learning to read and developing writing skills (Morere, 2011; Scott & Dostal, 2019).

However, there is a growing research base that shows that some signing deaf children bypass the phonological system and learn to read visually (Andrews et al., 2016). Still, we do not fully understand the cognition, linguistics, and the neuroscience of how deaf readers use their fingerspelling and signs to map onto print (Stone et al., 2016). What further complicates this challenge is that the linguistic structures of ASL and English are fundamentally different. One way to mitigate this challenge is to explicitly teach using ASL/English bilingual language teaching approaches, thus helping deaf students to transfer meaning from one language.

Signing deaf children mix, borrow, and transfer elements of their ASL and English skills into a type of code switching within and across languages during the reading comprehension and writing process. This often occurs in educational environments during English language arts instruction where teachers use the SimCom approach and the school program adheres to the TC philosophy. This language mixing is also part of deaf students' progress as a developing bilingual individual. They mix and blend the two languages because they have not fully internalized the rules of English nor ASL. This mixing of two languages is similar to an English language learner, mixing the native language with the new language. Deaf students' writing many times shows elements of the crossover between ASL and English, confusing morpheme development and grammar (see reviews by Paul, 2009). For example, a deaf student developing English writing skills may write English words in an ASL grammatical sequence.

One of the promises of cochlear implants has been to increase literacy achievement, but this may not be fully realized. Sarant et al. (2015) summarized studies and showed that children who are implanted early, during the critical period for language learning, exhibit better speech production and speech perception skills, but these spoken language skills do not always transfer to literacy skills. In another study, Geers and Hayes (2011) studied 112 students with implants longitudinally from elementary to high school. Between 47% and 66% of the children scored within or above average range compared to hearing controls on two tests of reading. However, the researchers found that deaf students had more difficulty with written expression, phonological processing, and spelling. They concluded that students who were not acquiring phonological skills may benefit from visual processing skills. However, in another study, Lederberg et al. (2014) found that deaf children with functional hearing do derive benefit from explicit instruction in phonological skills to improve their reading achievement. As literature is divergent, it is clear that the cochlear implant improves literacy for some, but not all deaf children with cochlear implants perform similarly to their hearing peers on standardized tests of reading.

As an alternative to speech-only methods, some professionals are recommending parents to use both ASL and English (Enns & Price, 2013; Hall et al., 2019; Humphries et al., 2012) to take advantage of having the child being exposed to bimodal bilingual language as early as possible. Psycholinguistically, this ensures the deaf child's brain is exposed to the patterns of both languages as early as possible. Psychosocially, assuming competence in both ASL and English allows both children and their families to flexibly move back and forth between the

two languages throughout the lifespan. For example, with deaf peers they can use ASL. With their hearing parents, hearing siblings, and friends they can use ASL, signed English, speech, lipreading, reading and writing, or a combination of these.

Having both means of communication also has practical benefits. The child can code-switch to ASL should their digital hearing aid and/or speech processor of the cochlear implant suddenly malfunction (Humphries et al., 2012). There are also English literacy benefits. Children can use their sign language to support their learning of English during early reading development and at higher levels of reading development (Andrews et al., 2016).

Academic Achievement

The annual Academic Bowl program sponsored by Gallaudet University is an excellent example of high academic achievement in deaf youth; videos of prior bowls are available on the internet. Watching these youths in action provides one with a holistic perspective of deaf youths using their cognitive, communication, and language skills including visual attention, memory, executive functioning, thinking before answering, self-correction, analytical skills (metacognition), and ToM (e.g. understanding the perspective of the other team members and announcer). Recently, teams from up to 80 public and deaf schools competed to answer challenging questions across the curriculum. They showed speed of recall, communication, reading, writing, spelling, math, problem-solving skills, and cooperative and collaborative reasoning and learning, motivation, study skills, and world knowledge. Of course, these are exemplary students who are likely from homes with supportive families, received early exposure to language, and had teachers who were deeply involved in their education.

Traditionally, standardized testing has been utilized to track deaf students' achievement and reading and math scores, which typically are below the hearing norm with the gap widening as the children get older (Cawthon & Leppo, 2013). Conceptual mathematical understanding as well as application and processes are built on a language foundation (Pagliaro & Karen, 2012). In a five-year longitudinal study of 197 deaf or hard-of-hearing children in general education classrooms for at least two or more hours per day, researchers found that the majority of the students scored in the average or above average range and made one or more years of annual progress on standardized measures of math, reading, and language/writing compared to hearing peers (Antia et al., 2009). Even though reading comprehension scores were in the low average range, they were closer to closing the performance gap with hearing students than deaf students discussed earlier in the Karchmer and Mitchell (2003) study. Access to the general education curriculum, family, teacher, and peer support all may have contributed to these students' gains (Antia et al., 2009). Both studies point out that even students with mild to moderate losses were at risk for low academic achievement, particularly in the area of reading comprehension.

Behavioral Challenges: Aggression, Violence, Sexual Abuse

School administrators working with deaf students encounter similar discipline problems as those who work with the general population. Discipline challenges such as oppositional defiant disorders, sexual harassment, sexting (sending pornographic messages and pictures), misconduct, gang activity, bullying, assault, violence, possession of drugs/alcohol, possession of weapons, theft, arson, bomb threat, and criminal damage also occur at schools for the deaf

(Jernigan, 2010). Most schools for the deaf are not equipped to handle students who need psychiatric treatment, leaving school administrators with few choices, and many feel forced to call law enforcement. Zero tolerance policies and other harsh approaches to student discipline often lead to the involvement of the legal authorities and are often the first step in a "School-to-Prison Nexus" (Civil Rights Project, 2003; Lomas, 2021). It can also open up costly lawsuits against school districts that do not provide behavioral programming for deaf students (Easterbrooks et al., 2004; Shaw, 2009), as well as lawsuits against prisons and juvenile corrections facilities that do not provide due process, protections, and services as mandated by the American with Disabilities Act (Guthmann et al., 2021; Vernon, 2009).

Prior to the passage of Public Law 94-142 in 1975, students who were deaf were primarily educated in relatively large numbers at residential schools for the deaf. However, since 1975, there has been a migration of deaf students from residential schools to local public schools. Moores (1987) identified an 18.3% drop in enrolment in public residential schools and a 69% drop in enrolment in private residential schools for the deaf between 1974 and 1984. Today, approximately 85% of children who are deaf or hard of hearing are educated in public school programs with 43% spending most of the school day in general education classrooms (Mitchell & Karchmer, 2011). With this migration has come the need for increased numbers of teachers to serve deaf students in public schools. However, essential student support services such as counseling, available and accessible at residential schools for the deaf, have not surfaced in public schools. Furthermore, students are often prone to disjointed communication at home as most hearing parents are not skilled at using sign language. These factors have coalesced to form unique behavioral challenges, especially for deaf students educated in public schools.

Sources appear to point to placement in public schools as a source of psychological and socio-emotional distress for deaf students. Public schools often lack certified teachers of the deaf, culturally Deaf role models, and an environment that affirms Deaf culture. Academic and psychological growth is predicated on one's participation in a communication-rich environment. Without a critical mass of peers and adults who are deaf, students may not have the necessary academic or social and emotional opportunities to foster their development in a manner equal to their hearing peers (Siegel, 2008). Perhaps this point is best illustrated by Johnson (2004), who stated, "It can be argued that the essential problem of deafness is not the lack of hearing but an abundance of isolation" (p. 76).

One of today's leading causes of deafness, CMV, can lead to children with shorter attention spans, impulse control issues, and a low tolerance for delayed gratification (Hamerdinger & Hill 2005). Children who are deaf are frequently diagnosed with attention deficit hyperactivity disorders (ADHD), conduct disorders, oppositional defiant disorder, or depression and anxiety (Theunissen, 2013). Limited language can lead to increased frustration for the child who is deaf, the development of poor social skills, poor self-image, and the inability to communicate basic and advanced needs. These language-based challenges result in behavioral challenges as deaf children are frustrated in an environment that overlooks their needs.

Students with disabilities may be at a higher risk for sexual harassment, both as the victim and the harasser (Lomas & Johnson, 2012). Deaf children and youth often lack insight into the use of appropriate social skills and how their actions affect social relationships (Gresham, 2002). Factors such as one's ability to communicate, lack of ToM, EF, social skills, and difficulties with relationships may feed into the increased risk of abuse among children and youth who are deaf (Lomas & Johnson, 2012).

Researchers (Schenkel et al., 2014; Sullivan & Knutson, 1998) report higher rates of maltreatment among deaf children and youth. Additionally, Sullivan and Knutson found that 25.8% of their participants who were deaf or hard of hearing endured significantly more physical abuse than maltreated peers without disabilities. Children who are deaf experience abuse over a longer term likely because they have fewer sources for outcry. For example, a typically developing student can report abuse to anyone at school from the bus driver to the school nurse and teachers, counselors, or other trusted adults. However, deaf students in public schools may see only one or two adults, a teacher and an interpreter fluent in sign language in a typical school day. The prevalence of abuse among deaf students continues to remain high today (Lomas & Johnson, 2012). Compounding the problem is the lack of accessible treatment options for deaf perpetrators. Often, children who are sexually assaulted grow to become teens who respond to their trauma by perpetrating sexual abuse on younger peers at school and in their communities, and deaf children are no exception to this sad reality. Due to a lack of accessible placement options for young deaf perpetrators, they are sometimes left on campuses and in communities where they continue to assault weaker children and peers (Lomas & Johnson, 2012). Teachers and other school personnel working with deaf students must be vigilant about child abuse identification, mandatory reporting, and responding.

The large number of social and emotional obstacles that children and youth who are deaf face as they develop is noteworthy. People who are deaf are overrepresented two to five times higher when compared to the hearing population in prisons (Harris & Mertens, 2021; Miller, 2002). In a demographic report published by the American Speech Language Hearing Association, Zingeser (1995) found that up to 30% of the inmate population nationally has a hearing loss. Another study (Iqbal et al., 2004) found that in the United Kingdom sex offenders who are deaf were overrepresented when compared to their hearing counterparts. O'Rourke et al. (2021) reported an overrepresentation of three times the expected numbers in UK prisons. This overrepresentation of individuals who are deaf or hard of hearing in the criminal justice system should be cause for alarm among parents and professionals. The implications of prelingual hearing loss on social and emotional behavior may be devastating if not addressed while children are young.

An estimate by Lomas (2021) indicates there are between 15,600 and 43,160 youth who are deaf or hard of hearing in the American juvenile justice system. Although a review of the causes goes beyond the scope of this chapter, it is important for readers to note that there is an increase in the number of deaf students who move from school to the justice system, known as the school-to-prison nexus (the nexus). The nexus for deaf and hard-of-hearing children is rooted in nine variables, including poor fund of information, cognitive factors, adverse childhood experiences, language and learning challenges, schools and the educational experience, problems with reimbursement for treatment, lack of treatment options, low literacy levels, and poor social cognition. However, there are other contributors to the pipeline including the increasing numbers of police with no disability training in schools, zero tolerance policies, complications with the justice system that increase the likelihood of false confessions and ensnare deaf people (Kassin, 2012), as well as other causes that are rooted in social injustice. While some of these causes are complicated, others can be addressed through education, advocacy, and policy change.

Assessment and Standards

Psychological Assessment

Psychological testing of children who are deaf has significant ramifications and should be done only by trained professionals and interpreted by an individual who has native language fluency in ASL. Psychological and educational evaluation is guided by Part B of IDEA and is a cornerstone of special education. Clearly, the desired scenario is to have an evaluator who has native fluency in ASL, who is deaf or hearing and knowledgeable about deafness, and who has the appropriate training in school psychology or educational diagnostics. However, there continues to be a paucity of evaluators who meet these criteria. Therefore, many school-based evaluators rely on their training in assessment to mediate the reduction in validity of test results. Although they are generally well meaning, their results are frequently flawed, leading to misdiagnosis, inappropriate interventions, and a breakdown in the education system for deaf students.

Most deafness-trained evaluators prefer to administer nonverbal tests when estimating the cognitive functioning of students with hearing loss. Contemporary evaluators who are trained to evaluate deaf students are increasingly sophisticated, often using cross-battery instruments to ensure validity of their findings. Generally, multiple procedures and instruments are used, depending on the communication abilities of the student. It's important to point out that evaluators who are not trained in assessment with deaf students and rely solely on nonverbal measures are still unlikely to obtain valid results. Instruments that require reading are often interpreted into sign language, a practice that is also likely to invalidate results as many signs reveal the answer when the question is interpreted. Generally, the lower the cognitive, academic, and linguistic function of the student being assessed, the greater the likelihood that standardized measures will be invalid and results will not represent the true functioning of the student. It's essential that examiners realize that it *may* be appropriate to administer verbal scales if the student has a mild hearing loss or is *late*-deafened. Still, results may not be indicative of true functioning. The importance of appropriate assessment cannot be overstated. Inaccurate test results are frequently the cause of inappropriate programming, placement, diagnoses, and treatment. In juvenile justice and other forensic settings, inaccurate test results are high stakes and may contribute to a poor defense, incarceration, and other consequences contributing to injustice.

Educational Assessment and Standards

Academic achievement among deaf learners is not on par with hearing or typically developing learners. Three decades of standardized testing data on over 12,000 deaf students show that reading performance among deaf students consistently hover at or around the fourth-grade level (Qi & Mitchell, 2011). Math achievement levels are slightly better, at the sixth-grade level. There remain numerous concerns over the quality of assessment data that exist on deaf learners. For example, some achievement tests may produce invalid scores simply based on the nature of their administration. Most literacy assessments done in the early years include phonological aspects, relying greatly on hearing ability; if these sections are omitted, the total score can be adversely impacted, and test results are invalid. The use of a sign language interpreter also can influence testing results in unexpected ways; certain signing can sometimes give away answers or impede conceptual understanding of the test prompt. Qualified professionals who are familiar with deaf learners can make a crucial difference in producing valid and accurate testing

results. States collect achievement performance data on all students, and the tests used, as well as methods of testing all vary widely. For example, Texas schools have their own learning standards and have adaptations for deaf students depending on students' background knowledge, learning styles, and modality needs. Other states require tests aligned with the Common Core Standards—a set of national standards for student knowledge and skills across all grade levels from kindergarten to 12th grade. Such standardized tests have "embedded universal accessibility systems" such as directions in ASL, captioning for English language listening items, and a scribe for a constructed response item (Mann & Prinz, 2006). The Every Student Succeeds Act (ESSA, 2015) gives states the option of accepting these national standards or using their own.

Communication and Language Assessment

Today, there are many options for language and communication assessment with deaf learners. Ideally, these tests are holistically determined by the child's IFSP and IEP team and focus on using evidence-based testing and assessment strategies to meet the child's unique circumstances. A comprehensive communication and language assessment of a child who is deaf should include the following: (a) A description of background variables that affect language learning such as age, age of onset, extent and type of hearing loss (audiogram provided by an audiologist); (b) home communication and language; (c) number of years using signing or other modalities; (d) previous early intervention and/or classroom-based assessments; (e) data from the student's IEP; (f) multi-pronged assessments of speech intelligibility, speech production, and speech reading ability; and (g) multiple language and literacy assessments that capture levels and growth over time (Cawthon, 2011; Pizzo & Chilvers, 2019).

Just like with literacy, it is also important to assess sign language levels in deaf pupils who rely on ASL or a sign system for access to language and communication. There are standardized ASL tests available from birth through postsecondary (Anderson & Reilly, 2002; Enns et al., 2013; Morere & Allen, 2012; Pizzo & Chilvers, 2019; Simms, Baker, & Clark, 2013), and the results of these assessments should guide the development of the child's IEP or IFSP. Ideally, ASL proficiency tests should be carried out by professionals who are fluent in ASL and qualified to conduct these assessments.

Educational Programming

Legal Mandates

There are educational legal mandates, mainly under the umbrella of special education and civil right laws, protecting the deaf student across the federal, state, and local levels. These protections have been largely in place since 1975, with the initial passage of the Education of Handicapped Children's Act, subsequently Individuals with Disabilities Act (IDEA) with multiple reauthorizations, most recently in 2004. While Leigh et al. (2018) provide a summary of the specific special education laws affecting deaf children, IDEA remains the most influential authority to date.

Under different parts of IDEA, deaf students are entitled to free and appropriate public education (FAPE) as well as placement in the least restrictive environment. Over recent years, there has been significant commentary over what exactly constitutes the "least restrictive environment" for students who are deaf. As written, the law remains that if a student can freely

access their academic programming using supplementary services and aids as noted on their IEP, then they should be placed in an educational setting alongside their nondisabled peers. Ultimately, the determination falls on the IEP team to review the child's status and progress to determine which placement provides the deaf student with satisfactory access and the least restrictive setting. Educational placement is always individualized per the student, yet remains a team decision and can change year to year, depending on circumstances that may impact the child's development and placement. What can also further compound the team decision would be the presence of other disabilities.

The student's parents also have rights according to Part A of IDEA. IDEA guarantees and protections, along with coverage, are in place for the deaf child and their parents until they graduate from high school or turn 21 (some states have additional mandates that allow the child to continue receiving services until their 22nd birthday.) While much attention is drawn toward K-12 schooling, a large and important portion of deaf education also includes birth to three (the formative years for language and social learning) and transition (preparing for adult and lifelong home and vocational responsibilities). Deaf students are entitled to these services through IDEA. Other aspects of their education such as confidentiality of information, student discipline, and technology support are also covered with the law (Raimondo, 2013).

In 2015, President Obama signed the Every Student Succeeds Act (ESSA), replacing the No Child Left Behind Act (previously reenacted). This Act provides states and educators more authority over the quantity and quality of assessments they provide for their students. However, the stakes are also raised; schools are expected to adhere to rigorous college and career readiness standards for all their students, those with and without disabilities. Evidence-based interventions must be used across the curriculum along with more transparent reporting of state standardized assessment data. Additional actions are also taken to protect and further develop underperforming schools.

School Settings

Depending on the region, there is a considerable continuum of placement options including total integration and inclusion in general education classrooms, self-contained classrooms, resource rooms, itinerant programs, team teaching, co-enrollment programs, or residential schools (Leigh et al., 2018; NASDE, 2018). Children who are deaf (or disabled) are generally encouraged to be integrated with nondisabled children as much as possible; however by law, their specific school placement should be determined *after* a child's educational needs are determined by the IEP team. In other words, the educational needs are assessed, and then the least restrictive placement in order to meet those needs can be determined. The most popular option focuses on mainstreaming, done in the spirit of full inclusivity; this model serves many children with disabilities but impacts deaf children differently due to communication barriers. For fully inclusive and equitable learning to take place, the deaf learner must have full and unfettered access to all aspects of their educational programming; this includes not only their classrooms, but also their daily school activities such as lunch, recess, and after-school activities. Social learning is a crucial part of language and physiological development; this relies largely on fluid exchange of communication and language. One advantage of the schools for the deaf is that there is a critical mass of students who can be grouped according to age, ability level, and language level. Also, schools for students who are deaf have certified teachers who

can sign and provide direct instruction without the use of an interpreter. Schools for the deaf also have qualified trained professionals who understand deafness who are able to provide assessments in cognition, socioemotional growth, communication, language, and academic achievement. These professionals usually can communicate directly with the deaf students. Children have a community of adults and peers with whom they can communicate at all times. One disadvantage is that students who live far from these schools may have to board, resulting in missing out on family experiences.

Having a small class size with desks in a semi-circle around the teacher within a consistent visual environment is believed to be helpful for deaf learners. Students in mainstream classes may have to divide their visual attention between the signing interpreter and the lips of the teacher to receive spoken language and this may be both challenging and tiring (Marschark & Hauser, 2008).

The disadvantage of public schools is that students who are deaf may be isolated in small programs without a group of peers who use ASL. The advantage of the general education classroom is that the content may be appropriately challenging if it's accessible to the child and if the child is functioning on grade level. The disadvantage is that instruction is not directly from the teacher to the student but through an educational interpreter. In some communities, educational interpreters may lack certification and may be the child's only sign model (Yarger, 2001). Many children who are deaf suffer isolation and social rejection in the mainstream and public school settings even though the academic content may be appropriately challenging (Caselli et al., 2020; Sheridan, 2001, 2008).

Itinerant services are frequently included in the educational programming for deaf students who attend public schools (Foster & Cue, 2008; Luckner & Ayantoye, 2013). A certified teacher of the deaf may travel to several schools within a district to provide direct services to deaf students outside the classroom; this would be considered a pull-out service. More recently, the trend has been moving toward push-in services and collaborative services. The itinerant teacher may work alongside the deaf student in the classroom while the general education teacher is delivering a lesson to all students. The itinerant teacher also meets with the teacher outside the classroom to provide guidance on setting up accommodations or to collect information about upcoming unit plans. This helps the itinerant teacher provide the deaf student with front-loading preparation such as learning vocabulary or practicing class strategies so that the student is put on more equal footing among their classmates.

Co-enrollment programs provide a large group of deaf students in one classroom with hearing peers and two teachers—one with deaf education certification and the other with general education certification. Outcome studies show that deaf children still lag behind their hearing peers academically, but this model provides more opportunities for socialization (Antia & Metz, 2014). Private and charter schools continue to be another option, and some schools have been set up to provide a particular language approach such as listening and spoken skills only or ASL/English bilingual. There are also increasing numbers of parents who are home-schooling their children with about 3.7% educated in the home (GRI, 2011).

Residential Schools

Traditionally, residential schools for the deaf are well known for being bastions of Deaf culture and ASL. Many residential school administrators have faced a threat of closing due to decreased enrollment and funding. The propensity for flawed interpretation (i.e., that all

students with disabilities *must* be integrated into general education classrooms) of the least restrictive environment has resulted in increasing numbers of deaf students being in inclusion settings in public schools, especially children of hearing parents. Technological advances, such as cochlear implants, have prompted medical personnel to advise parents to place deaf children in inclusion settings with hearing peers rather than at residential schools for the deaf with deaf peers. The development of vaccinations, such as the rubella vaccination, has decreased the incidence of individuals contracting rubella which may lead to hearing loss. However, other causes as addressed in the genetic syndromes section often result in deaf children with multiple disabilities. School administrators of residential schools are often in a position of defending the cost effectiveness of their schools as compared to public schools.

Schools for the deaf are being threatened with closure or combined with other special needs populations such as blind, autistic, developmentally delayed, or children with multiple disabilities. Listening device technology, computer-assisted real time captioning (CART), sign language interpreters, psychological services, comprehensive education, after-school activities, autism specialists, and behavioral specialists are costly. Furthermore, there is a growing number of youth who are deaf who are rejected by state schools for the deaf because the schools are not equipped nor staffed to serve them because these children and youth require medical and psychiatric care at a residential treatment center (Willis & Vernon, 2002).

Residential school administrators are challenged when state governments mandate funding based on student enrollment, as this doesn't account for the related costs of running an independent school. For instance, such calculations obfuscate the important services the state school provides, such as trained teachers, counselors, psychologists, and social workers who are familiar with Deaf culture and can communicate in ASL with children who are deaf. The interdisciplinary advantage that such professional teams working in residential schools provide cannot be as easily paralleled in large public school systems. Additionally, residential schools shoulder the costs of comprehensive programming (i.e., academic, sports, vocational programs).

Schools for the deaf often receive transfer students during their middle school years, when they have failed to develop reading and language in their home public school or have serious behavior challenges due to limited communication at home and at school. Schools often must accept children who are deaf and are medically fragile, in need of one-on-one care, who have cognitive disabilities, have autism, have emotional and behavioral disorders, who are victims of sexual abuse, are youths from juvenile correction agencies, are in foster care, and other complications. The reality is that deaf services are economically expensive, and there is no easy solution.

Public schools with classes for students who are deaf may have more options for funding, which may appear as an advantage initially. However, school costs may be even higher in public schools because students who are deaf are not centralized in one location, often resulting in a duplication of services. Local education agencies can go to the taxpayers and request additional funds through taxation. Alternative models for school programming for children who are deaf, such as co-enrollment programs of deaf and hearing children, private schools and charter schools, are also options.

Language Learning and Teaching Orientations

Across the United States there are a range of dual language and multilingual practices, which include spoken and sign language. For example, a deaf multilingual learner person may learn

some spoken Spanish, Arabic, or Chinese depending on the family heritage. They may also learn the signed language of their home country (such as Mexican Sign Language or Chinese Sign Language) and then learn ASL when they come to the United States. They may use a contact signing to mix, combine, or change languages depending on their conversational partner (Wang et al., 2016). Early dual language or bilingual learning is not always accessible to every deaf child as 96% come from hearing homes where the spoken language may be English, or may be spoken Spanish as 28.4% of deaf children are from Spanish-speaking homes (GRI, 2011). Further, Cannon et al. (2016) report that 19.4% to 35% of deaf children come from non–English-speaking homes, resulting in complex demands on schools and teachers. Because of this diversity, early childhood professionals and deaf educators recommend that deaf children, including those with cochlear implants, be exposed to a visual language from birth to take advantage of the sensitive period for language learning (Humphries, 2016) as well as to support later reading and school academic achievement (Hrastinski & Wilbur, 2016).

Despite the dichotomous approach to language modalities, deaf adults seldom report histories of having used just "one language." They routinely describe using a variety of practices including spoken language, speechreading, gestures, ASL, contact signing, fingerspelling, initialized signs, bimodal communication, reading, and writing. Some students comment they are more comfortable separating the two languages and others comment they prefer to integrate, blend, and mix their two languages cross-modally, particularly with communication with hearing relatives and friends who are not proficient in ASL.

In the following, we discuss three types of language teaching programming for deaf students: (a) The ASL/English bilingual bicultural approach, which also includes the bimodal bilingual approach; (b) the comprehensive approach; and (c) the monolingual aural/oral approach (Marschark, Lang, & Albertini, 2001; Leigh & Andrews, 2017).

ASL/English Bilingual/Bicultural Approach

This dual language programming uses ASL as the language of instruction and teaches English as a second language. English can be taught through spoken language or simply through reading and writing (sign print bilingualism). Spoken English can be taught through bimodal bilingual approaches in which the child is given models for both languages (Nussbaum et al., 2012). From the establishment of the first school for the deaf in 1817, teachers have aimed to teach both signing and English. In the 1960s, the theories of Jim Cummins and Stephen Krashen influenced conceptualizations of the bilingual approach for deaf children (Leigh et al., 2018). Humphries (2016) has pointed out the "imperfect match" between bilingual theories and deaf language learners and that new models of deaf bilingualism need to be developed. Strategies such as code switching, translating, chaining, preview-view-review, ASL summaries, and purposeful concurrent usage are just some of the bilingual strategies developed for deaf students (Andrews, 2012; Garate, 2011).

The bimodal-bilingual approach has gained popularity with children with cochlear implants. Bimodal education includes both auditory and visual sensory systems to develop language. In this approach, English is presented in its spoken format as well as its written format and ASL is presented visually. Bimodal bilingualism differs from total communication and simultaneous communication in significant ways. First, bimodal-bilingualism provides complete language models in both languages and requires careful language planning (Nussbaum et al.,

2012). Such language planning needs to be done by qualified language professionals, including but not limited to certified teachers of the deaf, bilingual coaches or specialists, speech language pathologists, interventionists, and school administrators. Parental input is also crucial. SimCom, and oftentimes TC, mix and blend the grammatical structures of both languages; therefore, they do not provide a complete model in either language. Researchers suggest these codemixes and codeblendings as language resources rather than language detriments (Plaza-Pust, 2014; Swanwick, 2015).

Comprehensive Approaches

The comprehensive approach is most widely used in schools and programs for deaf children (GRI, 2011). In this approach the lexical signs of ASL are used in manual codes of English, focusing on the grammar of English. This can take the form of TC, SimCom, or SSS. Critics claim that the two languages should not be mixed. However, as mentioned previously, language mixing has been re-thought as a "language resource" rather than a detriment. In addition, teachers in comprehensive programs, while not stressing the grammar of ASL, do use bilingual strategies such as code switching, expansions, chaining, and translating (Andrews & Rusher, 2010). Future studies are needed to describe the actual language practices teachers are using in these programs to see which approach is most effective. Since deaf students vary in their visual and auditory abilities, an eclectic approach that fits the unique and specific communication and language needs of the individual child should be the major consideration (Leigh & Andrews, 2017).

Monolingual Oral/Aural Approaches

Programs that emphasize one spoken language or monolingualism in spoken language are called Listening and Speaking Language (LSL) programs and use the LSL approach. Historically, it has been termed pure oralism/auditory stimulation, the multisensory/syllable unit method, the language association-element method, the unisensory or aural approach, or the auditory-verbal approach (Northern & Downs, 2014). Signing is not allowed in the classroom nor is Deaf culture or fingerspelling or any of the sign codes used. The goal of this approach is to assist with teaching the child spoken language so they can be integrated fully into the public school and hearing society. These programs are characterized by strong family involvement, amplification technology, and intensive speech training. Children in oral programs may use oral interpreters, notetaking systems such as CART, C-Print, or other captioning and speech-to-text software (Leigh & Andrews, 2017).

Transition to Postsecondary, Training, or Employment

Transition to a postsecondary, training, or employment is a preparation-based service for deaf students that begins as soon as they become of age (which can vary across states but generally begins between the age of 14–16 years old). The rationale for this has to do with the fact that while there are numerous resources to educate and train deaf adults, unemployment among this specific population remains persistently low. Approximately 53.5% of deaf people are employed compared to 70.4% of hearing people, and similar disparities can be seen across race, ethnicity, and gender (Bloom et al., 2023; Erickson et al., 2022). These numbers vary

from state to state; however, the global picture remains cause for concern. To ease workplace barriers, various legislative measures, such as Section 504 of the Rehabilitation Act of 1973, ensure accommodations be in place in postsecondary programs, training, and at the workplace.

As students who are deaf leave high school they transition to postsecondary school, training, or employment. Typically, they are eligible for state-funded vocational rehabilitation services. Over the years, however, there has been a decrease in such services followed by an increase in outreach programs. State agencies, including schools for the deaf, provide outreach programs for organizations, schools, or parents seeking resources (NASDE, 2018). Approximately 1.3% of all enrolled college students are deaf (Garberoglio et al., 2019). Approximately one-third complete their college degree within six years (Newman et al., 2016). There are many complex factors related to the gap between deaf and hearing college students, from lack of support services to assumptions that sign language interpretation and real-time text compensate for deaf students' lack of background knowledge and language deficits. Deaf college students who were interviewed have also alluded to challenges in acquiring specific traits such as effectively balancing their priorities or knowing how to seek available resources needed for functioning adulthood, for which they were inadequately prepared (Yuknis et al., 2021).

Gallaudet University, the National Technical Institute of the Deaf, and Southwest Collegiate Institute for the deaf are among the largest postsecondary programs in the United States. Each of these institutions has multiple support services in place, including oral and ASL interpreting, CART, and notetaking, among other support services. However, these services vary among institutions of higher education, and understanding of how to use these accommodations varies greatly. The Americans with Disabilities Act (1990) extends the protections for support services supplied by IDEA in K-12 and Section 504 of the Rehabilitation Act for the provisions that remove barriers to effective communication for the student who is deaf. There are also specialized transition programs for students with special needs such as cognitive delays, autism, and deafblindness (Ingraham, 2007). There are numerous kinds of assistive technologies available for deafblind adults such as Braille readers, closed circuit televisions, print enlargers, and print-to-voice software. Additionally, some of them may require paraprofessionals commonly referred to as intervenors (to provide visual and/or hearing support).

Technologies and Deaf Education

In general education classrooms and in schools for the deaf, visual technologies such as the videophone, text messaging, email, multimedia materials presenting stories in three languages (ASL, English, and Spanish), signing avatars, vlogs, and the use of C-Print and CART, which provide printed text of the spoken language within the learning environment, have increased both communication and learning of children who are deaf (Beal-Alvarez & Cannon, 2014; Marschark et al., 2006). When learning in online environments such as via Zoom, Teams, or Google Meets, students, especially those who are deaf and/or multilingual, may benefit from the use of auto-captioning or auto-transcribing. However, the accuracy level ranges from 80–95% depending on the platform, which is not a reliable means for receiving information for deaf participants.

Interactive boards (smartboards), white boards, and LCD projectors allow English text to be presented alongside the signing instructor or interpreter. Teachers can purchase subscriptions to download digital tools and software to create sign language instructional materials.

Parents, children, and families can take online ASL classes, many times offered for free through statewide initiatives and schools for the deaf outreach programs.

Due to the recent coronavirus pandemic, there has been increased use of digital learning platforms (e.g., Zoom, Teams, Google meet). Anecdotal evidence from deaf adults indicates that movements or lighting fluctuations on the screen are visually distracting. Unlike hearing people, deaf adult learners prefer to have the presenter's screen on, with their screen size dominant, and all others off or minimized during lectures. This ensures learners are better able to stay focused on content. Deaf children have the same challenges as hearing children related to inattention. Teachers of deaf children typically keep cameras on so they are able to check for understanding, monitor student behavior, and document nonverbal activity. However, the movements of those who are not the intended focus of attention can cause distraction in the digital classroom, making online learning even more difficult for deaf learners. Additionally, the use of sign language interpreters during video conferencing has created new etiquette considerations; there must be added coordination among the participants especially during screen sharing or interactive group discussions. Such rules need to be set explicitly for young deaf learners who may not understand how to advocate for turn taking or taking control of Zoom features.

Student Support and Student Discipline

We recommend centralized availability of mental health counseling services for students who are deaf for several reasons. First, centralized availability ensures communication access. When a provider or a group of providers are responsible for the services, it's more likely that the services will be delivered in an accessible and timely manner. When services are spread among providers who are assigned to campuses and do not know the needs of deaf students, it's likely that deaf students will be overlooked. Second, when mental health services are centralized, they remain stable and consistent over several years. Third, when providers can coordinate services K-12, deaf students are more likely to be exposed to a consistent developmental guidance program. When deaf students are placed in a neighborhood school, support services are often implemented by providers assigned to the building, a school counselor, psychologist, or social worker who uses an interpreter. If an ASL–fluent clinician is assigned to an itinerant role and works with deaf students K-12, deaf students are more likely to benefit. As of the publication of this *Handbook*, there is emphasis on the need for social-emotional learning, as well as diversity, equity, and inclusion. It is vital that school leaders and school helping professionals ensure that deaf students have access to programming that fosters their growth in this domain.

Need for More Research

Deaf education continues to change and advance as professionals in the field learn from current research and progressive technology advances that can assist instruction. While assistive technology devices, hearing technologies, and methods to provide accessible instruction may have improved, some areas still fall short of meeting the needs of deaf learners. Educational placements and services for students who are deaf with disabilities and/or deaf multilingual learners remain sparse, forcing the IEP team to choose settings that are available, rather than what may be the best placement for these complex deaf learners. This is consistent with

instructional strategies aimed to meet the needs of these diverse learners. Teachers rely heavily on best practices because evidence-based strategies for this population do not exist. The need for educational interpreters and certified teachers of the deaf has remained consistent over time, in a state of critical shortage. We need more research to determine whether a new school model of deaf education is necessary to reduce the challenges professionals in the field of deaf education face and to meet the ever-evolving needs of diverse deaf students.

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