Innovation Configuration

Evidence-Based Practices for Students With Sensory Impairments

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Table of Contents

List of Tables

Innovation Configuration for Evidence-Based Practices for Students With Sensory Impairments

This paper features an innovation configuration (IC) matrix that can guide teacher preparation professionals in the development of appropriate content for evidence-based practices (EBPs) for students with sensory impairments. This matrix appears in the Appendix.

An IC is a tool that identifies and describes the major components of a practice or innovation. With the implementation of any innovation comes a continuum of configurations of implementation from non-use to the ideal. ICs are organized around two dimensions: essential components and degree of implementation (Hall & Hord, 1987; Roy & Hord, 2004). Essential components of the IC—along with descriptors and examples to guide application of the criteria to course work, standards, and classroom practices—are listed in the rows of the far left column of the matrix. Several levels of implementation are defined in the top row of the matrix. For example, no mention of the essential component is the lowest level of implementation and would receive a score of zero. Increasing levels of implementation receive progressively higher scores.

ICs have been used in the development and implementation of educational innovations for at least 30 years (Hall & Hord, 2001; Hall, Loucks, Rutherford, & Newton, 1975; Hord, Rutherford, Huling-Austin, & Hall, 1987; Roy & Hord, 2004). Experts studying educational change in a national research center originally developed these tools, which are used for professional development (PD) in the Concerns-Based Adoption Model (CBAM). The tools have also been used for program evaluation (Hall & Hord, 2001; Roy & Hord, 2004).

Use of this tool to evaluate course syllabi can help teacher preparation leaders ensure that they emphasize proactive, preventative approaches instead of exclusive reliance on behavior reduction strategies. The IC included in the Appendix of this paper is designed for teacher preparation programs, although it can be modified as an observation tool for PD purposes.

The Collaboration for Effective Educator, Development, Accountability, and Reform (CEEDAR) Center ICs are extensions of the seven ICs originally created by the National Comprehensive Center for Teacher Quality (NCCTQ). NCCTQ professionals wrote the above description.

Hearing loss, visual impairment, or a combination of hearing loss and visual impairment of any type or degree potentially interferes with typical methods of interacting and learning. In 2011, students with sensory impairments comprised less than 2% of all children and youth with disabilities and 0.2% of the entire school-age population (U.S. Department of Education, National Center on Education Statistics [NCES], 2012). This small percentage reminds us that some school districts will never enroll a child with a sensory impairment of any type, and some teachers—even special educators—will never instruct a student with one of these disabilities. The low-prevalence nature of sensory impairments (i.e., consistently small numbers of children and youth across the United States in proportions that have remained relatively steady for more than 50 years) has resulted in misunderstandings, low expectations, and a lack of knowledge about EBPs simply because education personnel have lacked familiarity with how these students learn.

The test of any intervention or procedure is evidence—not "whatever works" but "what works." There may be more information about the effectiveness of various consumer products than the methods we use to teach children and youth with sensory impairments. For many reasons, educational research on students with sensory impairments is difficult to conduct. The population is geographically dispersed, making it difficult without considerable expense to identify an adequate group of study participants. Participants who are identified are often extremely heterogeneous and exhibit a range of diagnoses, functioning levels, and additional disabilities. Specialized schools, once the greatest source of research samples, no longer offer homogeneous populations and special curricula. In 2006, about 80% of students with sensory impairments attended general education classes in public schools for at least some of the school day (U.S. Department of Education, Office of Special Education Programs [OSEP], 2011, p. 59). Manipulation of variables in a controlled study, such as a reduction of services or alternate types of

services, often interferes with meeting legislative mandates. Simultaneously, school districts have been reluctant to consent to research because it takes away from other instruction.

For this collection of essential components, we have reviewed the research literature in our respective fields for high-quality research that meets the Collaboration for Effective Educator, Development, Accountability, and Reform (CEEDAR) Center evidence standards (see http://ceedar.education.ufl.edu/wp-content/uploads/2014/08/Evidence-Based-Practices-guide.pdf). Although there was strong research-based evidence of effective practices in some areas, the literature was often characterized by emerging practices and limited evidence. When no research was found on a specific aspect of a topic, we turned to legislation, policy documents, and textbooks to complete our analyses. We arranged this narrative first by the disability categories of

- deaf or hard of hearing,
- visual impairment, and
- deafblind.

Then, within each disability category, we addressed 12 topical areas critical to an analysis of EBPs in today's educational system for students with sensory impairments.

Deaf or Hard of Hearing

The term *hearing impairment* has often been used as legislative terminology to refer to the primary disability category for students who receive Individuals with Disabilities Education Act (IDEA, 2004) services through an individualized education program (IEP) for hearing loss. However, professionals in the field and individuals with hearing loss have preferred to use the terms *deaf* or *hard of hearing*.

It is important to recognize that the population of students who are deaf or hard of hearing has been found to differ from the general student population as well as from other students with

disabilities who receive IDEA services. In addition to typical factors that research has discovered influence the outcomes for hearing children and youth (e.g., intelligence, socioeconomic status of the family, ethnicity, community resources, quality of the K-12 educational program), an array of additional factors has also been found to affect the development of students who are deaf or hard of hearing. Examples include (a) degree of hearing loss; (b) type of hearing loss; (c) when hearing loss occurred; (d) when hearing loss was identified; (e) whether early intervention services were provided; (f) the quality and quantity of any early intervention services; (g) use/benefit from hearing assistive technology (AT; i.e., hearing aids, cochlear implants, frequency modulation [FM] systems, or communication boards); (h) home language of the family (i.e., American Sign Language [ASL], spoken English, and other spoken languages); (i) family attitude toward hearing loss; (j) any additional disabilities; (k) quality of home intervention and preschool services; (l) cultural identity (i.e., deaf, hearing, or hard of hearing and the interaction with other aspects such as race, ethnicity, language, and religion); (m) primary mode of communication preferred (i.e., spoken English, ASL, contact signing/Pidgin Sign English [PSE], Signing Exact English [SEE], or Cued Speech); and (n) where educational services are provided,

- a general education classroom with pull-out services from a teacher of students who are deaf or hard of hearing,
- a general education classroom with interpreter and/or notetaking services,
- a general education classroom in which part of the day is spent in a resource room,
- a self-contained classroom for students who are deaf or hard of hearing in a general education school,
- a general education classroom with students who are co-taught by a general education teacher and a teacher of students who are deaf or hard of hearing, or

- a special day or residential school program for students who are deaf or hard of hearing.

Given that the educational outcomes for students who are deaf or hard of hearing have been as varied as the population itself, the determination of appropriate services must be made on an individual basis, taking into consideration the factors noted above and the summary of the research literature that follows.

Administration

According to recent research, most professionals, including general education and special education administrators, are not deaf or hard of hearing and have limited experience or training in working with students who are deaf or hard of hearing (National Association of State Directors of Special Education [NASDSE], 2006; Szymanski, Lutz, Shahan, & Gala, 2013). As a result, professionals may not understand that hearing loss of any degree or type affects the quantity and the quality of interactions with others, which in turn may adversely impact language and academic, social, emotional, and career development.

To help make decisions that are in the best interests of students who are deaf or hard of hearing and their families, we have compiled the following recommendations based on the literature reviewed in this IC and requirements from the U.S. Department of Education:

- know the potential impact of hearing loss and the effects on a child's language, academic, cognitive, and social-emotional development as well as the impact on the family;
- know the U.S. Department of Education’s guidance policy on education services for students who are deaf or hard of hearing;
- learn about the cultural and linguistic needs of students who are deaf or hard of hearing;

- understand the population demographics and the educational implications of service to the increasing numbers of students who are deaf or hard of hearing who come from diverse ethnic, linguistic, and racial backgrounds;
- study the educational needs of students with hearing loss and additional disabilities;
- actively recruit qualified individuals who are deaf or hard of hearing and individuals who are from diverse ethnic, cultural, and linguistic backgrounds to serve in professional and support capacities within programs for students who are deaf or hard of hearing;
- have a system in place for monitoring students who are deaf or hard of hearing and delayed in developing communication and/or at risk for academic failure; and
- conduct follow-up surveys and interviews to determine how well graduates are doing in higher education, employment, living, citizenship, family life, and personal well-being (Conference of Educational Administrators of Schools and Programs for the Deaf [CEASD], 2013; NASDSE, 2006; The National Agenda, 2005; Szymanski et al., 2013; U.S. Department of Education, 1992; U.S. Government Accountability Office, 2011).

Teachers of students who are deaf or hard of hearing provide services via a variety of models (e.g., direct service to students, collaboration with general educators, co-teaching, consulting with families) in an assortment of settings (e.g., general education classrooms, specialized schools for students who are deaf or hard of hearing, resource rooms, self-contained classrooms, homes) with children and youth ranging in age from 0 to 21. Professional guidelines have not specified the size of caseloads, but they have recommended that certified professionals who teach students who are deaf or hard of hearing be integral members of each student's educational team.

The level of evidence for these administrative recommendations is emerging. It would be inappropriate to conduct studies comparing student performance without also describing the levels of professional services students had received. Thus, the professional literature written by experts in the field must serve as evidence.

Assessment

Conducting educational assessments of students who are deaf or hard of hearing can be challenging for several reasons: (a) students who are deaf or hard of hearing sometimes master the academic content; however, their abilities to demonstrate their knowledge may be compromised because of communication, language, reading, and writing delays (Cawthon, 2009; Gilbertson & Ferre, 2008); (b) norm-referenced tests may cause problems for students who are deaf or hard of hearing because tests require reading ability for assessing skills other than reading, and test scores may reflect reading skill deficits rather than students' content knowledge (Cawthon, 2009; Gilbertson, & Ferre, 2008; Luckner & Bowen, 2006); (c) it has been consistently reported that between 25% to 50% of students who are deaf or hard of hearing also have an additional disability (e.g., Blackorby & Knokey, 2006; D'Zamko & Hampton, 1985; Gallaudet Research Institute, 2011; Knoors & Vervloed, 2003) as well as the often-reported lack of language ability, attention problems, retention difficulties, and delayed academic skills, making it difficult to gather disability-specific data (Cawthon, 2007; Soukup & Feinstein, 2007); and (d) there have not been enough professionals who have the training and experience to assess students who are deaf or hard of hearing.

Another factor professionals should consider while conducting assessments with students who are deaf or hard of hearing is systematic error. Specifically, systematic error can lead to

inaccurate assessment results that produce poor decision making. Three common examples of systematic error with students who are deaf or hard of hearing that can limit the validity of a test are

- the directions of an assessment are orally read to students who use sign as their primary mode of communication,
- students who are deaf or hard of hearing and use sign are required to provide oral responses, and
- test items that are based on the ability to hear, such as matching words containing similar sounds, are included in the assessment (Gilbertson & Ferre, 2008; Luckner & Bowen, 2006; Wood & Dockrell, 2010).

Professionals should be knowledgeable about the differences between the terms *accommodations* and *modifications*. Accommodations (i.e., changes that help a student work around a disability and gain access to content) enable students with disabilities to perform in ways that would not be otherwise possible. Modifications change what students are expected to do during the assessment. As a result, with modifications, students are not evaluated on the same academic standards as their peers; consequently, the test norms cannot be used for comparative purposes. Professionals should adhere to the standardized test procedures while administering assessments. Any undertaken accommodations or modifications should be documented (Cawthon, 2009, 2011; Cawthon & The Online Research Lab, 2006, 2008; Cawthon, Winton, Garberoglio, & Gobble, 2011; Gilbertson & Ferre, 2008; Wood & Dockrell, 2010).

Professionals working with students who use sign as their primary mode of communication and who are not fluent in that language or system themselves may require the services of an educational interpreter. Professionals should be certain that the educational interpreter is skilled in the sign language or system the student uses to communicate, familiar with the assessment process

and instrument, and understands the importance of confidentiality (Gilbertson & Ferre, 2008; Maller & Braden, 2011; Wood & Dockrell, 2010). Finally, whenever possible, professionals should use a combination of procedures and instruments and avoid relying on a single test or assessment (Gilbertson & Ferre, 2008; Luckner & Bowen, 2006; Maller & Braden, 2011; Wood & Dockrell, 2010).

We consider the level of evidence for all assessment recommendations as limited because the research base is predominantly correlation studies and recommendations from the professional literature.

Assistive Technology

Students who are deaf or hard of hearing use an array of hearing AT to access sound. Examples include

- cochlear implants (CI);
- programmable digital hearing aids;
- bone-anchored hearing aids (BAHA);
- contralateral-routing-of-signal (CROS) hearing aids;
- tactile communication devices;
- personally worn, frequency-modulated (FM) amplification systems;
- classroom amplification systems; and
- accompanying peripherals such as microphones, earmolds, and chargers.

Professionals' knowledge of the use and maintenance of the equipment is important to the academic success of this population of students (Punch & Hyde, 2011; Spencer, Marschark, & Spencer, 2011). In addition, with the interest in and success of cochlear implants, postimplant therapy has

become an increasingly important area of expertise for teachers working with students who are deaf or hard of hearing.

Age at implant and consistency of device use are two factors shown to influence outcomes for individuals with cochlear implants (Connor & Zwolan, 2004; Geers, Brenner, & Tobey, 2011; Geers & Hayes, 2011; Geers & Sedey, 2011). However, studies have found that it is wrong to assume that once implanted, students can hear like the typical hearing person (Beadle at al., 2005; Geers et al., 2011; Hawker et al., 2008). Like other equipment, cochlear implants require training for the students and preparation for the teachers to help students effectively use them (Harkins & Bakke, 2011). Similarly, students with cochlear implants have been found to require ongoing support from professionals because they are likely to have listening difficulties in some social and educational contexts. As a result, some students have not had full access to school curricula or activities promoting social inclusion (Hyde, Punch, & Grimbeek, 2011; Punch & Hyde, 2011).

Studies have noted that making decisions about communication approaches and choosing which AT to use may be stressful for families (Archbold, Lutman, Gregory, O'Neill, & Nikolopoulos, 2002). Therefore, professionals should continue to advise with caution about the range of likely outcomes; they should also be aware that families are likely to be influenced by their hopes and aspirations for their children as much, if not more, than by the information they receive (Spahn, Richter, Burger, Lohle, & Wirsching, 2003). Consequently, information-sharing processes should be regularly repeated, extended, and evaluated through ongoing discussion and counseling (Archbold et al., 2002).

AT services may also include the use of sign language interpreters, tutors, and/or notetakers. Research has supported the benefits of having professionals teach students how to (a) use support services, (b) self-advocate about technology and support-service issues, and (c) troubleshoot

technology problems (Punch & Hyde, 2011; Spencer et al., 2011). At the same time, it is important for service providers to respond with flexibility as the needs of students and parents change over time, especially when expected outcomes are not achieved and alternative strategies and approaches are necessary.

We consider the level of evidence for all AT recommendations as limited because the research base is predominantly correlation studies and professional literature.

Communication

About 95% of children who are deaf or hard of hearing are born to hearing parents who have little or no prior knowledge or experience with how to effectively communicate with a child who is deaf or hard of hearing (Mitchell & Karchmer, 2004). When parents do not make adaptations, such as moving into the child's visual space, using hearing AT, or using sign, most children who are deaf or hard of hearing experience significant reductions in communicative interactions. This may cause delays in the development of language, which may adversely impact academic, social, emotional, and career development (e.g., Calderon & Greenberg, 2003; Mayberry, 2010).

To promote communication and language development, three general approaches have been commonly used: (a) oral methods—the use of hearing AT, such as cochlear implants and hearing aids, along with training to learn to use residual hearing and speech read; (b) manual methods—the use of ASL, a visual-gestural language that has its own grammar and syntax; and (c) simultaneous communication methods—signs are produced in the same order as spoken words and at the same time as the words are spoken. Although there are proponents for each approach, to date, no approach has been demonstrated to be more effective than others. Some children using each approach have developed age-appropriate communication and language skills, and other children using the same approaches have not (Yoshinaga-Itano, 2003b). Also, many families change the

communication approach they originally selected during the first few years of their child's life (Meadow-Orlans, Mertens, & Sass-Lehrer, 2003; Stredler-Brown, 2010).

Correlational studies have suggested that the communication approach selected by families is not as important as (a) parental involvement (Calderon, 2000; DesJardin, 2006; Spencer, 2004); (b) children's non-verbal cognitive abilities (Geers & Sedey, 2011); (c) the presence or absence of additional disabilities (Waltzman, Scalchunes, & Cohen, 2000); and (d) the quality of educational programming (Knoors & Hermans, 2010; Pianta et al., 2005) on the acquisition and development of communication and language skills. Similarly, survey research (e.g., C. W. Jackson, 2011; Meadow-Orlans et al., 2003) has indicated that parents want unbiased information about communication approaches as well as time and support from professionals and other parents of children who are deaf or hard of hearing in order to determine which communication approach to use with their children.

There is a limited but increasing body of research indicating that the quantity and quality of interactions with skilled language users during children's optimal developmental phase for acquiring language affect the communication skill development of children who are deaf or hard of hearing.

Early Identification and Early Intervention

Newborn hearing screening has led to increased numbers of children identified with hearing loss before they leave the hospital. This permits the implementation of specialized early intervention services. Without specialized early intervention services, children who are deaf or hard of hearing have been found to experience significant delays in their communication and language abilities, their social-emotional development, and, ultimately, the quality of their lives (Sass-Lehrer, 2011). Multiple correlational studies have indicated that children and families who receive early

intervention services during the optimal period for the development of linguistic and cognitive abilities have better outcomes than children and families who began receiving services later (e.g., Calderon & Naidu, 1999; Kennedy, McCann, Campbell, Kimm, & Thorton, 2006; Moeller, 2000; Yoshinago-Itano, 2003a, 2003b; Yoshinago-Itano, Coulter, & Thomson, 2001; Yoshinaga-Itano & Gravel, 2001; Yoshinago-Itano, Sedey, Coulter, & Mehl, 1998). In the United States, 6 months of age has been identified as the critical deadline for the establishment of intervention services (Joint Committee on Infant Hearing, 2007).

Early identification of hearing loss neither eradicates nor lessens the processes of grief and loss experienced by most hearing families (Vohr et al., 2008; Young & Tattersall, 2007). Consequently, specialized early intervention services provided by trained professionals focus on supporting families dealing with the stress of having a child who is deaf or hard of hearing, helping them make a choice about the communication method they will initially use with their child, and strengthening the families' abilities to nurture their child's development and overall well-being. Family-professional partnerships and program services, which are established based on the needs of the child and the priorities of the family, have typically included emotional support and information on a variety of topics such as hearing AT; communication options; and strategies for promoting language, speech, and auditory development (Sass-Lehrer, 2011). However, parents have reported that the Early Hearing Detection and Intervention (EHDI) system can be overwhelming, emotionally taxing, and difficult to navigate (Larson, Munoz, DesGeorges, Nelson, & Kennedy, 2012; Meadow-Orlans et al., 2003). Consequently, professionals must provide parents and guardians with information that is repeated over time and in different ways (e.g., discussion, notebooks, websites). Simultaneously, children's language development, regardless of communication mode, should be regularly assessed to ensure that children are meeting language

milestones and evaluate whether other interventions are needed (Meinzen-Derr, Wiley, & Choo, 2011).

We consider the level of evidence for all early identification and early intervention recommendations to be moderate because a large body of correlation research has consistently demonstrated the positive effects on children and families.

Life Skills

Professionals should conduct assessments to determine students' current levels of performance and establish whether they need curricula that include an emphasis on life-skills instruction (e.g., safety, banking, cooking, purchasing skills; Luckner, 2012; Luft, 2012; Luft & Huff, 2011). General types of assessments have included formal testing and informal techniques such as observation, structured interviews, work sample analysis, and performance assessments (Cronin, Patton, & Wood, 2007). Research (Test et al., 2009) focusing on EBPs that predicts improved postschool outcomes for students with disabilities has found that four predictor categories are correlated with successful outcomes in the areas of education, employment, and independent living:

- inclusion in general education,
- paid employment/work experience,
- self-care/independent living skills, and
- student support from family members and friends.

Consequently, professionals should consider these predictors and the EBPs associated with them while planning programs for students who are deaf or hard of hearing.

As previously discussed, a high percentage of students who are deaf or hard of hearing also has an additional disability. The presence of disabilities in addition to hearing loss compounds the

complexity of providing appropriate educational services. The additional disabilities make individuals' special needs qualitatively different and often result in a variety of challenges across several domains such as communication, cognition, affective, social, behavior, and physical (Jones, Jones, & Ewing, 2006). Another portion of the population may not be identified with an additional disability but may exhibit limited communication and reading abilities as well as poor social and emotional skills (Wheeler-Scruggs, 2002, 2003). Consequently, a large percentage of individuals who are deaf or hard of hearing have been found to leave school and experience difficulty living independently or maintaining employment (Bowe, 2003; Dew, 1999; LFD Strategic Work Group, 2004). Therefore, in order to proactively meet the needs of students who are deaf or hard of hearing with additional disabilities and those who are not benefiting from a purely academic focus, professionals should gather assessment data and develop an educational plan that takes into consideration the knowledge and skills needed to live independently and put into place the types of supports these students will need when they exit their formal education programs.

We consider the level of evidence for all life-skills recommendations to be limited because the research base is predominantly correlation studies and professional literature.

Literacy

Many skills and experiences contribute to the acquisition of literacy (National Reading Panel [NRP], 2000). Two essential skills relevant to the challenges of students who are deaf or hard of hearing are language abilities and the ability to use spoken phonological knowledge for decoding printed words (Lederberg, Schick, & Spencer, 2013). Language skills are necessary for successful reading skill development. Research on early literacy with hearing children indicates that language skills are central to early and long-term literacy success (e.g., Biemiller, 1999; Se'ne'chal, Ouellette, & Rodney, 2006). However, many children who are deaf or hard of hearing

begin formal schooling with little fluency in either a spoken or signed language or awareness of print and literacy concepts (Marschark & Wauters, 2008). Similarly, many children who are deaf or hard of hearing do not have easy access to the phonological code that allows them to map the spoken language they already know to the printed words on a page. Additionally, natural sign languages, such as ASL, have their own vocabularies, morphologies, and syntaxes that do not parallel those of spoken or printed English (Fischer & van der Hulst, 2011).

Given the diversity of the population of students who are deaf or hard of hearing, it is practical to consider interventions that are effective for two separate groups of individuals: (a) students who are deaf or hard of hearing with functional hearing and (b) students who are deaf or hard of hearing with limited functional hearing (Easterbrooks, 2010; Lederberg et al., 2013). For students with functional hearing, interventions should be guided by the recommendations of the NRP (2000) for a balanced reading program, including phonemic awareness, phonics, fluency, vocabulary, and text comprehension (Luckner, Sebald, Cooney, Young, & Muir, 2005/2006; Schirmer & McGough, 2005). To help students who are deaf or hard of hearing gain access to phonological-related information, quasi-experimental research has suggested that visual phonics, a multisensory system of hand cues and corresponding written symbols that represents the phonemes of English, may be effective (e.g., A. Smith & Wang, 2010; Trezek & Malmgren, 2005; Trezek, Wang, Woods, Gampp, & Paul, 2007). For students who have limited functional hearing, it has been contended that knowledge of signs and their meanings can be associated with printed words and that finger spelling, which provides a visual representation of printed letters, can serve as a direct aid to decoding print (e.g., Bailes, 2001; Haptonstall-Nykaza & Schick, 2007; Padden & Ramsey, 1998; Strong & Prinz, 1997).

As previously noted, children with age-appropriate language skills have a distinct advantage in becoming literate. However, it is no longer assumed that language development must precede the emergence of literacy skills but that literacy activities promote language development, and the two can be mutually supportive (e.g., Williams, 2004). Parent-child reading provides an excellent context for parents to communicate with their child and enhance language development. Research (e.g., Zevenbergen & Whitehurst, 2003) has demonstrated that parent-child reading is associated with many aspects of language growth of typically developing children as well as children with communication problems (e.g., Ezell, Justice, & Parsons, 2000). Longitudinal research (e.g., Crain-Thoreson & Dale, 1999) has demonstrated the relationship among experiences with shared picture book reading and later language skills. Several correlational studies and one intervention study suggest that interactions while reading books with students who are deaf or hard of hearing are also beneficial (e.g., Andrews & Taylor, 1987; Delk & Weidekamp, 2001; DesJardin, Ambrose, & Eisenberg, 2009; Fung, Chow, & McBride-Chang, 2005; Swanwick & Watson, 2005).

Summaries of research in the critical areas of comprehension, vocabulary, and fluency indicated that students with or without functional hearing benefit from

- explicit instruction in strategies for comprehension;
- teaching narrative structure or story grammar;
- using modified directed-reading thinking activities;
- activating students' background knowledge prior to reading activities;
- using high-interest, well-written reading materials that are not simplified grammatically or in vocabulary choice;
- conversations to build vocabulary skills;
- explicit instruction in sight words and morphemic analysis;

- computer programs to develop vocabulary; and
- repeated readings to improve reading fluency (e.g., Easterbrooks & Stephenson, 2006; Luckner & Cooke, 2010; Luckner & Handley, 2008; Luckner & Urbach, 2012; Schirmer & McGough, 2005).

Correlation research (e.g., Fagan, Pisoni, Horn, & Dillon, 2007; LaSasso & Davey, 1987) has suggested that a positive relationship between vocabulary and reading comprehension exists for students who are deaf or hard of hearing. Consequently, it is beneficial for professionals to identify ways to increase the vocabulary of students. Research has confirmed the benefits of teaching students high-frequency words (e.g., Easterbrooks, Lederberg, Miller, Bergeron, & Connor, 2008; Paul & Gustafson, 1991); introduction of key words using rich and explicit examples (e.g., de Villiers & Pomerantz, 1992); and instruction in inferential strategies to assist vocabulary development (e.g., Strassman, Kretschmer, & Bilsky, 1987). In addition, research has supported the use of repeated readings to improve students' word recognition, reading rates, and comprehension (Ensor & Koller, 1997; Schirmer, Therrien, Schaffer, & Schirmer, 2009).

We conclude that the level of evidence for the literacy recommendations is moderate for some suggestions and limited for others. Because literacy is composed of multiple aspects, more research is available to support some recommendations, and additional research must be undertaken in order to increase the level of evidence in other areas.

Mathematics

Research (e.g., Traxler, 2000) has indicated that the majority of students who are deaf or hard of hearing graduate from high school performing at a sixth-grade level in math procedures and a fifth-grade level at problem solving. Three factors have been associated with the performance of students who are deaf or hard of hearing. First, the language delay experienced by many students

who are deaf or hard of hearing may limit their mathematics performance (e.g., Hyde, Zevenbergen, & Power, 2003; R. R. Kelly & Mousley, 2001). Conditionals and technical vocabulary may hinder their understanding of mathematical concepts and performance in problem solving (Pagliaro, 2010). Examples of conditionals are if/then statements; comparatives (e.g., less than); negatives; and abbreviations (e.g., lb.); an example of technical vocabulary is *annual rate*. Second, the low reading levels of many students who are deaf or hard of hearing may diminish their successes due to difficulty understanding the necessary computation based on word problems. Research has consistently demonstrated a strong correlation between reading proficiency and mathematics, regardless of the type of mathematics investigated (R. R. Kelly, Lang, & Pagliaro, 2003). Third, limited incidental learning opportunities and informal learning experiences may also negatively influence the mathematics performance of students who are deaf or hard of hearing (Kritzer, 2009).

Instruction should be guided by the *Principles and Standards for School Mathematics* established by the National Council of Teachers of Mathematics (NCTM, 2000) and the National Mathematics Advisory Panel (2008). However, research on mathematics instruction for students who are deaf or hard of hearing has shown an emphasis on memorization and drill-and-practice exercises/worksheets as well as on limited use of technology or investigation of open-ended problems (Pagliaro & Ansell, 2002, 2012; Pagliaro & Kritzer, 2005). Students who are deaf or hard of hearing need more (a) experience solving and constructing story/word problem presented in various forms as the basis for mathematical thinking, communication, and higher order concepts; (b) explicit use and teaching of technical mathematics vocabulary; and (c) integration of mathematics concepts and thinking skills throughout the curriculum to promote problem solving, analysis, and explanation (Pagliaro, 2010; Pagliaro & Kritzer, 2005). Also, because many students who are deaf or hard of hearing have an additional disability (e.g., Blackorby & Knokey, 2006;

Gallaudet Research Institute, 2011) or are functioning significantly below their chronological ages (Bowe, 2003; Wheeler-Scruggs, 2002), some students will need functional mathematics instruction such as money value, budgeting, identifying units of liquid and dry measure, height and weight measurement, time management, temperature, graphic representations, and time related to scheduled events and calendars (Bowe, 2003; Wheeler-Scruggs, 2002).

The level of evidence for all mathematics recommendations is limited because the research base is predominantly correlation studies and professional literature.

Placement/Inclusion

Placement—where students receive educational services—is an issue that has generated continuing debate. Some professionals have expressed concern that the language, communication, and social needs of students who are deaf or hard of hearing are not being met in general education settings (e.g., CEASD, 2013). However, to date, there has been no research to support the assertion that placement in and of itself is an important factor. In contrast, a study comparing the educational consequences of different placements by Stinson and Kluwin (2003) reported that placement accounts for less than 5% of the differences in noted achievement. Therefore, it is more appropriate to focus on effective teaching—curriculum, instruction, assessment, classroom organization, and management—as the key components of the educational process for all students, including those who are deaf or hard of hearing.

Similarly, the ability of teachers to establish learning environments in which students are actively and productively engaged in learning has been shown to be a better predictor of student success than the mode of communication used by teachers (e.g., teachers who sign for themselves, use an interpreter, use simultaneous communication, use ASL without voice accompaniment) or whether teachers are deaf or hearing (Antia, Jones, Reed, & Kreimeyer, 2009; Marschark, Sapere,

Convertino, & Pelz, 2008; Reed, Antia, & Kreimeyer, 2008). However, due to the heterogeneity of the population of students who are deaf or hard of hearing, professionals should be skilled in communicating with students who use different modes of communication (NASDSE, 2006).

Because placement is not synonymous with appropriate services, professionals must systematically monitor student progress. After collecting, analyzing, and sharing data about student functioning, the IEP team can make adjustments, if needed, in what is taught, how it is taught, and sometimes where it is taught based on how the student's current functioning compares to other students (Antia, Sabers, & Stinson, 2007; Berndsen & Luckner, 2012; Karchmer & Allen, 1999; Powers, 2003; Reed et al., 2008). In addition, professionals trained in working with students who are deaf or hard of hearing should be able to adapt instruction and help other professionals adapt instruction for students who are deaf or hard of hearing (Antia et al., 2009; Antia, Stinson, & Gaustad, 2002; Luckner & Muir, 2001; Powers, 2003; Reed et al., 2008). Specifically, they should consult and collaborate with other professionals about strategies for promoting access to instruction and social interactions in all educational environments and to family members for the home and community (Antia et al., 2009; Antia et al., 2002; Kluwin, Stinson, & Colarossi, 2002; Luckner & Muir, 2001; Powers, 2003; Reed et al., 2008). Simultaneously, professionals trained in working with students who are deaf or hard of hearing should provide ongoing PD and support for other service providers who have not been trained to work with but provide services to students who are deaf or hard of hearing (Antia et al., 2002; Luckner, 1999; Nunes & Pretzlik, 2001; Powers; Reed et al., 2008). Finally, professionals should help students become involved in extracurricular activities in the school and the community (Luckner & Muir, 2001; Reed et al., 2008).

The heterogeneity of the population of students who are deaf or hard of hearing, as well as the variety and combination of placements for educational services, make it difficult to compare the

effectiveness of one setting to others. Consequently, we consider the level of evidence for all recommendations on placement/inclusion as limited because they are based on correlation research and professional literature.

Science

Research has shown that the lags in reading comprehension, vocabulary, and experiential knowledge for many students who are deaf or hard of hearing negatively affect their knowledge of science concepts (Lang & Steely, 2003; Vosganoff, Paatsch, & Toe, 2011). Many science teachers use textbooks and multimedia, such as movies and television shows, for science instruction. Both the print in most science texts and the captions of science films and television shows are often too difficult for many students who are deaf or hard of hearing to understand (Lang, 2006). Also, many science teachers use lectures to disseminate content. Lectures can also prove difficult for students who are deaf or hard of hearing. Specifically, many students struggle to understand science concepts because they have not been exposed to the vocabulary of science (Easterbrooks & Stephenson, 2006), and about 60% of the words considered important in a science curriculum do not have sign representations (Lang et al., 2007). Consequently, research has suggested that students who are deaf or hard of hearing benefit from instruction from teachers who are well prepared in the content area of science and who are also able to effectively communicate with them (Easterbrooks & Stephenson, 2006). In addition, given the challenges of accessing science content via text or lecture, researchers have noted that students who are deaf or hard of hearing may benefit from instruction that includes

- physical manipulation of objects,
- use of graphic organizers,
- highly pictorial or animated content with simplified English text, and

- additional practice on vocabulary (e.g., Barman & Stockton, 2002; Diebold & Waldron, 1988; Easterbrooks & Stephenson, 2006; Elefant, 1980; Lang & Steely, 2003; Mertens, 1991).

The level of evidence for science recommendations is limited because the research base is predominantly correlation studies and professional literature.

Social-Emotional/Behavior

Results of research on the impact of hearing loss on social, emotional, and behavioral development have been mixed (e.g., Andersson, Rydell, & Larsen, 2000; Antia, Jones, Luckner, Kreimeyer, & Reed, 2011; Coll, Cutler, Thobro, & Haas, 2009; Vogel-Walcutt, Schatschneider, & Bowers, 2011). Some students were found to show greater impulsivity, poorer emotional regulation, loneliness, and difficulty getting along with others. In contrast, many other students were found to have good communication skills, emotional understanding of self and others, friendships, and self-motivation (Calderon & Greenberg, 2003). Similarly, mixed results have been reported while trying to attribute differences to factors such as (a) degree of hearing loss, (b) mode of communication used by students, and (c) educational setting (Antia, Kreimeyer, Metz, & Spolsky, 2011).

Research (e.g., Austen, 2010; Barker et al., 2009) has suggested that compared to their hearing peers, children and youth who are deaf or hard of hearing exhibit higher rates of externalizing (e.g., aggression, violating social rules) and internalizing (e.g., anxiety, depression, social withdrawal) behavior problems. The language delays experienced by many students who are deaf or hard of hearing interfere with emotional and behavioral regulation. Language, which aids in internalizing social norms and the development of behavioral control, also plays an important role

in executive function such as attention regulation, planning, problem solving, and response inhibition (Morgan & Lilenfield, 2000).

As a result of language development delays; limited opportunities for incidental learning; and the unfamiliarity of parents, families, and caregivers who are deaf or hard of hearing, it is prudent for professionals to proactively think about promoting the healthy growth and development of social, emotional, and behavioral knowledge and skills. For children ages 0 to 3, involving families in comprehensive early intervention programs can foster healthy attachments and communication skills that facilitate their children's development (Calderon, 2000; Hintermair, 2008; Luckner & Velaski, 2004). It is important to help elementary-age students develop the language and understanding of (a) emotional self-awareness, (b) emotional self-regulation, (c) motivation, (d) empathy, and (e) social skills (Goleman, 2006). Research has demonstrated the effectiveness of social-skills training (e.g., Antia, Kreimeyer, & Eldredge, 1994; Ducharme & Holborn, 1997; Schloss & Smith, 1990; Schloss, Smith, & Schloss, 1984). Similarly, Providing Alternative THinking Strategies (PATHS), a school-based curriculum for promoting alternative thinking strategies, has been demonstrated to help students who are deaf or hard of hearing to effectively develop and maintain self-control, increase their ability to communicate about feelings, and improve their problem-solving abilities (Kusche & Greenberg, 1993).

Adolescence is a critical time for the formation of identity and social relationships. Correlation research (e.g., Luckner & Muir, 2001; Reed et al., 2008) has suggested that participation in after-school and/or community activities provides adolescents with opportunities for socialization, shared experiences, achievement, and distinction. Through their involvement with activities such as sports, drama, drawing, computers, photography, and chess, students can learn to master skills that will help them throughout their lives. Active participation in after-school and/or

community activities helps students to develop their leadership and decision-making abilities as well as organizational, time management, and interpersonal communication skills.

Given the previously mentioned risk factors and potential academic delays, it is important for professionals to conduct formal and informal assessments of students' social-emotional and behavioral functioning in order to intervene in a timely manner. In addition to observation and the use of standardized behavior rating scales, professionals can use the Classroom Participation Questionnaire (CPQ; Antia et al., 2007) and Placement and Readiness Checklists for Students Who Are Deaf and Hard of Hearing (PARC; Johnson & Seaton, 2012) to collect data about how students are functioning.

We consider the level of evidence for social-emotional/behavior recommendations to be limited because the research base is predominantly correlation studies and professional literature.

Transition

Research findings on the educational and employment outcomes for individuals who are deaf or hard of hearing have been mixed. In the past 10 years, graduation rates with regular high school diplomas have increased from 58% to 68% for students who are deaf or hard of hearing (U.S. Department of Education, 2009). As a result, these individuals have enrolled in postsecondary education programs at a high rate (i.e., 67%) that is similar to their hearing peers (Wagner, Newman, Cameto, & Levine, 2005a). However, for a variety of reasons, about 75% of these students have left school without either a 2- or 4-year degree (Lang, 2002; Marschark & Hauser, 2008; Stinson & Walter, 1997).

In the area of employment, some individuals who are deaf or hard of hearing have achieved great success. Professionals who are deaf or hard of hearing have been represented in almost every line of work (Foster & MacLeod, 2003). However, research (e.g., Boutin & Wilson, 2009b;

Capella, 2003; Mowry, 1988) has indicated that workers who are deaf or hard of hearing are more likely to work in non-professional jobs (e.g., food processing, printing, welding) and earn less than the general hearing labor force. In addition, studies have found that many low-functioning individuals who are deaf or hard of hearing do not work (Bowe, 2003; Wheeler-Scruggs, 2002). The Social Security Administration (2013) reported for 2012 that 64,950 individuals in the United States who are deaf or hard of hearing collect Supplemental Security Income (SSI).

To prepare students who are deaf or hard of hearing to successfully transition to postsecondary education programs and/or the workforce, professionals should provide them with information about careers and facilitate the development of self-determination and self-advocacy skills (Bowe, 2003; Brolin & Loyd, 2004; Sitlington, Neubert, Begun, Lombard, & Leconte, 2007). Additionally, professionals should involve students in the development of IEP and transition goals and should have students participate in IEP meetings (Velaski, 1999).

Professionals should also use formal and informal assessments to gather information from students, families, and other professionals about students' current levels of functioning and future aspirations. Using these data, professionals can use a backward planning process to create a vision of what is most important for a students' future success and determine actions that must be undertaken and in what order. Once a plan has been established, the information can be translated into a course of study that integrates the necessary knowledge, skills, and transition goals into the IEP and then implemented with coordination across individuals, organizations, agencies, and settings (Luckner, 2002, 2012).

Studies have shown that many students who are deaf or hard of hearing demonstrate limited knowledge or skills in the areas of independent living (e.g., budgeting, bill paying, contractual agreements, cooking and nutrition, family planning) and employment (e.g., organization, time

management, collaboration, planning; Bonds, 2003; Bowe, 2003; Luckner, 2002, 2012; Luft, 2012; Luft & Huff, 2011; Punch, Hyde, & Creed, 2004). Consequently, professionals should provide instruction in these critical areas during high school and work with vocational rehabilitation (VR) counselors to help individuals who are deaf or hard of hearing prepare for adult life (Boutin, 2009; Bowe, 2003; Punch et al., 2004). Research by Boutin and Wilson (2009a) has indicated that three factors—job placement, provision of AT devices, and job-search assistance—are the primary VR services that contribute to clients finding and maintaining employment.

Professionals should also help students who plan to attend postsecondary institutions succeed. Correlation research has found that the English, Natural Science, and Mathematics subscores of the American College Test (ACT) predicted the academic success of college students who are deaf or hard of hearing for the year studied. The English subscore accounted for more than 80% of the variance. Neither audiological variables related to degree of hearing loss nor communicative variables related to spoken language or ASL skills were predictive factors (Convertino, Marschark, Sapere, Sarchet, & Zupan, 2009).

The level of evidence for all transition recommendations is limited because the research base is predominantly correlation studies and professional literature.

Conclusion

We live in a sound-oriented society. Extensive amounts of information are deliberately and incidentally conveyed through verbal interactions with others. Through these interactions, children and youth

- refine their communication skills;
- acquire language;
- obtain information (i.e., background and domain knowledge) about the world;

- learn concepts;
- become literate;
- develop social skills; and
- participate in the daily activities of life.

Hearing loss of any type or degree tends to alter the quality of sound (i.e., softer, distorted, or non-existent) that travels to the inner ear and brain stem, which then has the potential to change interaction patterns with others and adversely impact development that may lead to language, literacy, social, and academic delays.

Determining and establishing the most appropriate educational environment for each student who is deaf or hard of hearing require a series of difficult decisions such as the following examples:

- What services are needed?
- Where should the services be provided?
- Which professionals will provide the services?
- Which primary mode of communication will be used?
- Which AT options, like FM system, interpreters, and/or notetakers, will be needed?
- What should be the focus of the curriculum?
- Which adaptations will be beneficial?
- How will progress be monitored?

Because placement is not synonymous with appropriate services, professionals must examine the learning environments of students who are deaf or hard of hearing. In order to meet the communication, academic, and social needs of these students, students' progress must be systematically monitored using assessments that compare students' learning rates and levels of performance to expected benchmarks so that timely adjustments can be made. These data allow

professionals to develop a comprehensive continuum of supports and services and adjust the intensity and nature of the interventions when students are not making appropriate progress. This helps to ensure that students achieve targeted, standards-based learning goals within set time frames.

Visual Impairment

> [The] special topic report has shown that many students with a visual impairment receive accommodations and disability-related services from their schools or districts. Academically and socially, many of them appear to be quite successful; however, a substantial minority [of students] is doing less well. The considerable heterogeneity among students classified as "visually impaired" highlights the need for educators to look beyond "the label" and tailor instruction, accommodations, services, and supports to students' individual needs. (Marder, 2006, p. 25)

Marder (2006) continued by comparing and contrasting students with visual impairments who participated in the Special Education Elementary Longitudinal Study (SEELS, pp. 23-24; see Table 1).

Table 1

Comparison of Students With Visual Impairments Who Participated in SEELS

	Students With Low Vision	Students Who Are Blind
Curriculum Access	Use large print and/or optical devices	Use Braille, Braille notetakers, Braille writers, books on tape, and/or screen access software
IEP Goals	Focus on academic skills	Focus on academic skills, functional skills, and orientation and mobility
Orientation and Mobility	Few or no difficulties	Good skills indoors and in familiar areas, but half of students have difficulties with unfamiliar locations

This fairly accurate description of students with visual impairments demonstrates not only the heterogeneity of children identified as visually impaired, but also the great range of educational services required. Regulations implementing IDEA (2004) define *visual impairment including blindness* as "an impairment in vision that, even with correction, adversely affects a child's educational performance. The term includes both partial sight and blindness" (34 C.F.R. § 300.8(c)(13)). In this review, the terms *low vision* and *blind* refer to students who generally meet Marder's (2006) descriptions above, although individual studies cited below may use more specific definitions to describe their participants. Both terms used here —*visual impairment* and *visually impaired*—refer to the entire group of students who are blind and have low vision.

Given that the educational outcomes for students with visual impairments are highly variable, the determination of appropriate services must be made on an individual basis, taking into consideration the summary of the research literature that follows.

In this review, we highlighted some of the essential components that are most important while educating students with visual impairments in both general education and specialized settings. We also examined the level of evidence supporting the epistemology of educating infants, children, and youth with visual impairments.

Administration

Important issues surrounding the administration of educational programs serving students with visual impairments focus on credentialed personnel, supervision, workload, and access. IDEA (2004) requires that students with visual impairments be served by licensed or credentialed teachers who have training and experience in visual impairment and are involved in assessment and writing of IEPs as well as in direct teaching according to the individual child's needs (U.S. Department of Education, 2000). The two most appropriate types of personnel are (a) teachers, certified or licensed by the state education department, who teach students with visual impairments and (b) orientation and mobility (O&M) instructors certified by the Academy for Certification of Vision Rehabilitation and Education Professionals (ACVREP) or through some states' own systems (U.S. Department of Education, 2000). These licensing procedures guarantee that students with visual impairments will receive instruction from qualified personnel and that other educational personnel will have access to such personnel for consultation and problem solving. Guidelines for providing services to students with visual impairments and supervision of personnel have been developed by NASDSE (Pugh & Erin, 1999).

Personnel serving students with visual impairments generally do so in an itinerant model in which they travel among several schools within a district or across multiple districts that comprise a region; thus, driving time becomes part of the workday and is one of the considerations in determining caseload size. Other considerations include student needs for direct instruction in

reading and writing Braille, use of technology, classroom instructional materials that require translation into accessible formats, and teacher conferencing time (Michigan Department of Education, 2013; Olmstead, 2005; Spungin & Ferrell, 2007; U.S. Department of Education, 2000). Although related research indicates that mean caseload size ranges from 14 to 20 students (Correa-Torres & Durando, 2011; Correa-Torres & Howell, 2004; Murphy, Hatton, & Erickson, 2008; Olmstead, 1995; Suvak, 1999), the *National Plan To Train Personnel* recommends a caseload of eight students (C. Mason, Davidson, & McNerney, 2000); other sources recommend eight to 12 students (Hazekamp & Huebner, 1989; Koenig & Holbrook, 2000a), depending on student needs.

There is conflicting evidence about the relationship between student achievement and amount of instruction. Ferrell (1993) determined that greater student competence in Braille reading and writing, academic subjects, and orientation and mobility were associated with longer periods of instructional time. However, Wall Emerson, Sitar, Erin, Wormsley, and Herlich (2009) reported that lower achieving students had more instructional time, smaller class sizes, and more available materials. This difference in conclusions may be attributable to increased attention to students with disabilities in addition to visual impairment since 1993 and/or the fact that lower achieving students in the Wall Emerson, Sitar, and colleagues (2009) study were educated in specialized settings, and the Ferrell (1993) subjects were predominantly in inclusive settings. In both studies, placement and achievement appear to be factors in the delivery of services.

Other considerations for caseload size include delivery of the expanded core curriculum (Hatlen, 1996, 2003) and the need for instruction in areas not traditionally part of the school curriculum but critical for children who do not learn by observation and visual imitation (Corn, Hatlen, Huebner, Ryan, & Siller, 1995; DuBose, 1976; Ferrell, 1997; Huebner, Merk-Adam,

Stryker, & Wolffe, 2004). Such instruction has been acknowledged in *Policy Guidance*, issued by the U.S. Department of Education (2000), and a 2013-issued *Dear Colleague* letter (Musgrove & Yudin, 2013). *Policy Guidance* also acknowledges extending instruction beyond the school day, suggesting that students may benefit from working with personnel who provide services in non-traditional ways (e.g., at home, in the community).

Education of students with visual impairments has been greatly enhanced at the American Printing House for the Blind by the 2004 creation of the National Instructional Materials Accessibility Standard (NIMAS) and the National Instructional Materials Accessibility Center (NIMAC), now making the goal of providing instructional materials to students with visual impairments at the same time as children without disabilities a real possibility (Association for Education of the Blind and Visually Impaired [AER], 2013; Pugh & Erin, 1999). Authorized by the IDEA amendments of 2004, NIMAC is a technical standard publishers use to create multiple formats (e.g., Braille, large print, audio) for books and instructional materials, greatly reducing the amount of time required to create adapted materials.

Orientation and mobility instruction was first identified as a special-education-related service in the 1997 amendments to IDEA (1997). Children and youth with visual impairments, with and without additional disabilities, are entitled to orientation and mobility instruction as a related service (IDEA, 2004; Pugh & Erin, 1999; U.S. Department of Education, 2000). Note that the essential components related to this topic are included in this review under the Life Skills section of this paper.

In recent years, paraeducators have increasingly been assigned to students with visual impairments enrolled in general education classrooms (Forster & Holbrook, 2005; Lewis & McKenzie, 2000)—but not without some controversy. A paraeducator can be a valuable asset to

the educational team, but the literature cautions against supplanting direct instruction from the teacher of students with visual impairments (TSVI) with the services of personnel without training in visual impairment, accommodations, or Braille reading and writing (Conroy, 2007; Ferrell, 2007; Forster & Holbrook, 2005; Griffin-Shirley & Matlock, 2004; Koenig & Holbrook, 2000d; Lewis & McKenzie, 2000; McKenzie & Lewis, 2008). The concerns about an overreliance on paraprofessionals are particularly focused on (a) lack of preparation and (b) interference with the student's independence and interaction with the classroom teacher and peers (Conroy, 2007; Forster & Holbrook, 2005; Giangreco, Edelman, Luiselli, & MacFarland, 1997; Giangreco, Halvorsen, Doyle, & Broer, 2004; Giangreco, Yuan, McKenzie, Cameron, & Fialka, 2005; Harris, 2011; Lewis & McKenzie, 2000; S. U. Marks, Schrader, & Levine, 1999; McKenzie & Lewis, 2008; Russotti & Shaw, 2001). Research supporting these assertions, however, is just emerging; see Harris (2011), who found more interaction between students and their teachers and peers when paraeducators were at a distance.

The level of evidence for recommendations for administration of programs serving students with visual impairments is emerging, primarily because these are informed by expert opinions rather than empirical data. The recommendation for caseload size is considered limited. Although caseload size has not been directly tested, there have been multiple studies documenting the number of students served by teachers.

Assessment

Assessment considerations for children and youth with visual impairments are similar to those for students with other sensory disabilities. Personnel with experience and training in visual impairment are required by law to participate in the assessment process, and assessment must utilize a variety of measures, both formal and informal, to evaluate development, educational

achievement, and access to the general curriculum (IDEA, 2004; Olmstead, 2005; Pugh & Erin, 1999). Such personnel should also consider the interaction of residual vision, additional disabilities, environment, learning strategies, and unique skills needs. Assessment is made more difficult because there are no reliable and valid instruments for students with visual impairments (Bowen & Ferrell, 2003; Ferrell, 2011; Groenveld & Jan, 1992; L. Hunt, 2001; J. C. Miller & Skilman, 2003; Singh, 2004). Thus, the results of an assessment are, at best, considered an underestimate of performance. Cattell (1940), who attempted to measure intelligence in young blind children, found no difference in skill acquisition, providing the children had been previously exposed to the skill and, therefore, knew what was expected. This lack of exposure can be attributed to visual impairment itself and the lack of opportunity to learn through observation, modeling, visual imitation, and visual feedback. This opportunity is often referred to as *incidental learning* (Ferrell, 1997, 2011). For children with visual impairments, incidental learning cannot be assumed to have occurred (Ferrell, 1997, 2011; Lowenfeld, 1973; Warren, 1994). To reiterate, test results are generally considered an underestimate of performance. The U.S. Department of Education (Musgrove &Yudin, 2013) has acknowledged that "the challenge for educators of blind and visually impaired children is how to teach skills that sighted children typically acquire through vision" (p. 2).

Personnel experienced and trained in visual impairment conduct at least two types of assessments: (a) a functional vision assessment to estimate how a student is using his or her remaining vision and establish the accommodations and modifications, including the use of low-vision devices and technology, needed in order for the student to progress in the general education curriculum (Corn & Erin, 2010; Lueck, 2004) and (b) a learning media assessment (Bell, Ewell, & Mino, 2013; Koenig & Holbrook, 1995) to determine the sensory channels through which

a child learns and assess reading and writing skills as required by IDEA (2004), specifically evaluating a student's need for instruction in Braille (see also Musgrove & Yudin, 2013; U.S. Department of Education, 2000).

Musgrove and Yudin (2013) recently reinforced these assessment components by stating,

> the evaluation of vision status and the need (or future need) for Braille instruction should be thorough and rigorous, include a data-based media assessment, be based on a range of learning modalities, including auditory, tactile, and visual, and include a functional visual assessment. (p. 3)

Assessment of infants and toddlers with visual impairments is conducted in partnership with family members and utilizes a routines-based approach (Hatton, McWilliam, & Winton, 2003; Pugh & Erin, 1999). In terms of statewide assessments, about 18% of students with visual impairments participated in alternate assessments; only 6% did not participate in any statewide testing (Marder, 2009).

We consider the level of evidence for the assessment recommendations to be emerging because these are based on expert opinions, public policy, legislation, and documented practice. Although media assessments are widely used and have been validated for assessment purposes, there is little evidence that their use results in the correct decision regarding a student's reading medium. Functional vision assessments, which are not standardized, must be considered unreliable because different teachers can obtain different results with the same student. Nevertheless, these two procedures are critical to the assessment process, and research to establish the reliability and validity of these practices is needed.

Assistive Technology

In spite of its potential to facilitate Braille instruction and the development of early Braille literacy skills (McCall, McLinden, & Douglas, 2011; U.S. Department of Education, 2000), AT for students with visual impairments has not been widely researched, and the literature is limited to product reports and case studies. Practice guidelines require educators to ensure that technology is available to students with visual impairments (Pugh & Erin, 1999); however, empirical research examining technology as an intervention or instructional strategy has been limited to audio description (Carver et al., 2012; Ely, Wall Emerson, Maggiore, O'Connell, & Hudson, 2006; Ferrell, Finnerty, & Monson, 2008) and the use of technology on standardized tests (Freeland, Wall Emerson, Curtis, & Fogarty, 2010). Freeland and colleagues (2010) found that AT did not level the playing field in terms of performance of youth with visual impairments on standardized tests in which variability was attributed more to age, race, and gender than to use of technology. Audio description, on the other hand, holds promise as a testing accommodation. Carver and colleagues (2012) demonstrated that Braille readers were more likely to accurately respond to standardized questions in English/language arts, mathematics, and science when descriptions were provided during test administration. Students reading print in this study were equally likely to accurately respond both with and without description, indicating that image description is an unbiased accommodation that makes the content accessible to Braille readers without giving them an unfair advantage.

The U.S. Department of Education (2000) professionals stated that AT is an effective method for teaching writing and composition. Koenig and Holbrook (2000a) have recommended providing instruction in technology skills for 30 min to 60 min per day until the student is competent. However, there is some evidence that AT is not being well implemented in the

education of students with visual impairments (Hume, 2011; S. M. Kelly, 2009, 2011; S. M. Kelly & Smith, 2011; D. W. Smith, Kelly, Maushak, Griffin-Shirley, & Lan, 2009), although S. M. Kelly (2009) did document greater technology use in specialized schools than in general education settings. The lack of technology utilization may be attributable to the adults surrounding students with visual impairments, who are more likely to be digital immigrants (Prensky, 2001); the majority of teachers who serve students with visual impairments may not be digital natives like the students themselves, who are growing up with technology. Their teachers may employ technology in more limited ways.

Some researchers (Kamei-Hannan, Howe, Hererra, & Erin, 2012; Zhou et al., 2012) have demonstrated that teachers of students with visual impairments are more confident and more likely to teach technology to their students (a) when they have completed a course about technologies for students with visual impairments and (b) when knowledge and skills in technology are periodically renewed through PD. Hume (2011) found a significant positive correlation between the amount of training teachers received and their use of technology with their students. Interestingly, Hume also found a significant negative correlation between teachers' caseload sizes and their use of technology with students. Reduction of caseload size and ongoing training of personnel in AT may lead to greater technology implementation in the future.

McCall and colleagues (2011) determined through an extensive review of the literature that the provision of low-vision services and other technologies optimizes access to print and Braille. The U.S. Department of Education (2000) recommended that IEP teams determine if a particular child needs school-purchased AT devices in the home. This recommendation clearly places responsibility on the schools to assist students with visual impairments in generalizing technology use to all environments.

A promising line of research is emerging from Bickford and Falco (2012), who found no difference between early Braille readers using traditional paper Braille and those using an electronic notetaker. Using an alternating-treatments design, the students easily transitioned between paper Braille and electronic Braille and demonstrated learning in both conditions. D'Andrea (2012) also studied youths' use of paper Braille and AT and found that students used a wide variety of devices to accomplish a myriad of tasks. Future research may lead to earlier integration of technology that reaches the potential McCall and colleagues (2011) and the U.S. Department of Education (2000) envisioned.

We consider research in the use of AT to be limited. Although there are numerous articles, there are more promising descriptions of practice than controlled studies. The exception is the moderate amount of evidence supporting the individualized prescription, training, and use of low-vision devices, which are discussed in the Literacy section of this paper. Although low-vision devices may be considered low tech, there is also an emerging line of research investigating the integration of technology into educational programs for children and youth who use Braille. Because technology is becoming commonplace in schools, further research in this area is warranted.

Communication

There is conflicting evidence that children with visual impairments experience delays in language development that may hamper acquisition of literacy skills (Bigelow, 1987; Erickson & Hatton, 2007b; Fraiberg, 1977; Preisler, 1995; Urwin, 1978; cf. Ferrell, 1998). General professional agreement supports strategies that assist children who are blind and visually impaired to acquire language skills (Erickson & Hatton, 2007a; Ferrell, 2011; Wormsley & D'Andrea, 2000), including

- expansion of verbal language and non-verbal cues;

- short and simple sentences to follow directions;
- questions that engage children or clarify their understanding;
- use of concrete objects to label and explore;
- use of songs, nursery rhymes, and chants;
- use of rich descriptions and feedback; and
- book sharing.

Ferrell (1998) determined that many language milestones were acquired earlier by children with visual impairments, and others fell within a range of performance. Pérez-Pereira (1999) confirmed that appropriate pronoun usage by children with visual impairments occurred within the same age range as for typical children.

Research in language and communication in children with visual impairments must be considered emerging. The articles cited here are primarily practice reports, expert opinions, or are descriptive in nature.

Early Identification and Early Intervention

Children with blindness and low vision have received early intervention services since the 1930s (Ferrell, 2000) because vision loss was believed to create an extreme developmental disadvantage that families could not address on their own. Studies conducted in the 1940s and 1950s demonstrated that (a) children with vision loss followed a developmental trajectory much like that of typically developing children, and (b) any gaps in development were due more to a lack of experience/exposure than to the vision loss itself (Cattell, 1940; Maxfield & Buchholz, 1957; Norris, Spaulding, & Brodie, 1957; Singh, 2004). Later studies attributed developmental delays directly to blindness (Fraiberg, 1977) or the presence of additional disabilities (Ferrell, 1998). Only 10 infants were involved in the Fraiberg (1977) study; 184 infants and their families were involved

in the Ferrell (1998) study. Ferrell documented large variability among subjects; about one fifth of the children performed at the same rate as their peers without disabilities, and poorer vision, including blindness, was not associated with poorer outcomes, but more severe disabilities, in addition to visual impairment, were. However, all participants in the Ferrell study received early intervention services, which may have contaminated the results.

Growth-curve analysis in a related study (Hatton, Bailey, Burchinal, & Ferrell, 1997) demonstrated marked differences in developmental patterns, attributed in part to the severity of vision loss and the presence of additional disabilities. In this analysis, children with additional disabilities were found to have lower developmental ages and slower rates of growth. Also, children whose visual acuity was 20/800 or less had lower developmental ages in all domains and slower rates of growth in personal-social and adaptive domains. The presence of additional disabilities and severity of vision loss did not interact but had an additive negative effect on children's development.

Early intervention services are generally considered mandatory for infants and toddlers with visual impairments (Ferrell, 2000, 2011; Hatton et al., 2003; Murphy et al., 2008). Although only anecdotal evidence is available, these services are believed to be more effective if personnel are trained and certified in visual impairment fields and services are designed to establish routines within the home environment (Ferrell, 2000, 2007; Hatton et al., 2003; Murphy et al., 2008), although opportunities to meet with other families of children with visual impairments are also important (Ferrell, 2000, 2011). Developmental areas that appear to be at greatest risk for children with visual impairments are cognitive and motor-skill areas (Erickson & Hatton, 2007a, 2007b; Ferrell, 2000, 2011; Hatton et al., 2003; Murphy et al., 2008). Kesiktas (2009) stated that giving attention to developing orientation and mobility skills and supporting parent-child interactions are

also needed. Lueck, Chen, Kekelis, and Hartmann (2010) provided effective practice guidelines and strategies for promoting early child development in infants and toddlers with visual impairments.

Because Barraga's (1964, 1965) dissertation research demonstrated that children with low vision improved scores on visual perception tests after a period of training, attention has focused on younger children. Studies with older children (Geffen, 1971; Mamer, 1999) have demonstrated positive effects of systematic training. A small number of studies have examined visual stimulation or visual development programs among infants and preschoolers, but the results have been mixed. Some studies have demonstrated that visual-evoked responses or visual acuity improved with systematic intervention (Leguire, Fellows, Rogers, Bremer, & Fillman, 1992; Moore, 1989; Tsai, Meng, Wu, Jane, & Su, 2013), but other studies have found no effect for similar programs (Ferrell, 1983, 1984; Lopez-Justicia & Marton, 1999). Ferrell (1983, 1984) and Lopez-Justicia and Marton (1999) documented increased visual acuity in study participants, but both studies attributed the result to maturation rather than to the intervention.

Although early intervention for infants and toddlers with visual impairments has a long history, the evidence for the efficacy of early intervention is more philosophical and anecdotal than empirical. Research has focused on documenting developmental risks and delays, primarily in comparison to children without disabilities. Specific interventions, such as those designed to improve visual skills, have had mixed effects. Although there are multiple studies on visual development, each study used different procedures and outcome measures to demonstrate effects. In the absence of a cohesive body of research, the evidence for early intervention must be considered emerging.

Life Skills

Educators of students with visual impairments have long included instruction in life skills as an important component of the services they provide. These services were first identified by Spungin (1977) but have also been supported by Alonso (1987), DuBose (1976), Hazekamp and Huebner (1989), Koenig and Holbrook (2000b), and Spungin and Ferrell (2007). Instructional services in skills and behavior that lead to adulthood include adaptive technology and AT, orientation and mobility, leisure and recreation skills, social interaction skills, independent living skills, career education, and visual efficiency. Since 1996, these educational needs have been known as the *expanded core curriculum* (Hatlen, 1996). The need for this specialized instruction is attributed to the impact that visual impairment has on learning and the resulting limitation in observation, visual imitation, and demonstration and feedback. The emphasis on standards-based education limits the amount of time available to address this type of instruction.

The importance of attention to life-skills instruction is demonstrated in the Newman and colleagues (2011); Wagner, DiAmico, Marder, Newman, and Blackorby (1992); and Wagner, Newman, Cameto, and Levine (2005b) studies. In these analyses of the National Longitudinal Transition Studies (NLTS, NLTS2), students with visual impairments, when compared to students with other categories of disability, spent the greatest amount of time in general education classes and had higher rates of high school graduation and postsecondary education, although they had lower rates of competitive employment. They also received more life-skills training after graduation. Although students with visual impairments made gains in these areas in the decade between the two studies, especially in comparison to students with other disabilities (Wagner et al., 2005b), only 55.4% of young adults with visual impairments lived independently at the end of the second transition study (Newman et al., 2011). In a survey of parents about independent living

skills, Lewis and Iselin (2002) found that parents of children with visual impairments reported that their children were able to independently perform only 44% of tasks, but parents of children without visual impairments reported that 84% of living-skills tasks could be independently performed. The proportions of young adults with visual impairments who were married (i.e., 8.3%) or who were parents (i.e., 10.7%) were among the lowest of all categories of disability studied by NLTS2 (Newman et al., 2011).

The U.S. Department of Education (2000) acknowledged in *Policy Guidance* the importance of instruction in areas not usually taught by educators when it stated that the IEP team may need to address compensatory skills, extended school-year services, social interaction skills, recreation and leisure skills, career education, and visual efficiency skills in order to ensure access to the general education curriculum. Similar to the evidence provided in the section later in this paper that addresses students who are deafblind, children and youth with visual impairments require systematic instruction to acquire skills in dressing, eating, grooming, hygiene, and self-care. There is some evidence that children who acquire these skills are more competent in their social interactions, are better integrated into their communities, have larger support systems, and may have better opportunities for employment (Bina, 1991; DeLaGarza & Erin, 1993; DeMario, 1990; Lewis & Iselin, 2002; Rettig, 1994).

The U.S. Department of Education (2000) recognizes orientation and mobility as an essential component of special education. The ability to move around the home and community is a "fundamental and enabling life skill" (Huebner & Wiener, 2005, p. 579) taught to children and youth by certified orientation and mobility specialists (COMS) and is identified as a related service by IDEA (2004). Marder (2006) documented in SEELS that a large majority of blind students (i.e., 78%) with and without mental retardation or developmental disabilities received orientation

and mobility services; a smaller percentage of low-vision students (i.e., 36% to 38%) with and without mental retardation or developmental disabilities received these services. In the NLTS2 study, 54% of youth with visual impairments received these services, according to Cameto and Nagle (2007). They found that the provision of orientation and mobility services was influenced by (a) placement—students who attended specialized schools were more likely than students in regular schools to receive the services and (b) severity of visual impairment—students who were blind were more likely than those with low vision to receive the services.

Orientation and mobility training was developed shortly after World War II to assist blinded veterans in returning to their communities (Koestler, 2004; Wall Emerson & Corn, 2006). Today's orientation and mobility instructors are trained in techniques that were developed with blind adults with notable exceptions (Dodson-Burk & Hill, 1989; Hill, Rosen, Correa, & Langley, 1984). As a result, child orientation and mobility services have evolved over the years from the pedagogy of adult services, although Wall Emerson and Corn (2006) acknowledged that "the effect of visual impairment on the development of children and youth is significant enough that they are taught concepts and skills different from those for people who lose their vision as adults" (p. 332). Wall Emerson and Corn also pointed out that different university programs have different emphases and that there is a range of opinion regarding what constitutes orientation and mobility services for children and youth with visual impairments.

Using an expert Delphi technique, Wall Emerson and Corn (2006) identified several components of an orientation and mobility curriculum for children and youth. There is professional agreement that orientation and mobility begins in early childhood with

- sensory skills,
- concept development,

- motor development, and
- environmental awareness practiced in the home and community.

This progresses to formal orientation and mobility training such as

- cane travel and
- street crossings (Anthony, Bleier, Fazzi, Kish, & Pogrund, 2002; Anthony, Lowry, Brown, & Hatton, 2004; Budd & La Grow, 2000; Dodson-Burk & Hill, 1989; Franks, 1974; Hill et al., 1984; Wright, Harris, & Sticken, 2010).

Still, there is little empirical evidence supporting orientation and mobility instruction in the schools or identifying which instructional techniques work best for which children. Wright and colleagues (2010) conducted a literature synthesis of this research, but it was limited to the use of tactile maps and models. Berlá (1973) and Berlá and Murr (1975) examined scanning approaches and task time for tactile materials (particularly maps) and concluded that tactile materials should be as simple as possible with few background textures. Wright and colleagues (2010) suggested utilizing Braille reading strategies (e.g., two-hand approach, left-to-right movement) while reading maps. However, Wright and colleagues concluded that "the three experimental studies . . . cannot be assumed to be applicable to the greater population of children with visual impairments because of the lack of replication, restrictive sampling techniques, artificial environments, and other limitations" (p. 104).

This seems to be the case for the entire area of life skills. The research literature is sparse, so most of the evidence is based on expert opinions. Although there is professional consensus regarding the expanded core curriculum, which includes orientation and mobility, there is emerging yet contradictory evidence that provision of the expanded core curriculum has any effect on student educational and postschool outcomes.

Literacy

Literacy is the key to social and economic opportunity (Bell & Mino, 2013; Musgrove & Yudin, 2013; Rex, Koenig, Wormsley, & Baker, 1964; Ryles, 1996; Schroeder, 1996). The U.S. Department of Education (Musgrove & Yudin, 2013) has specifically emphasized Braille literacy as an important factor in future employment. Education of students with visual impairments has always been about providing access to print or finding an alternative modality that will provide an equivalent quality and quantity of information. Instruction follows the evidence-based principles identified by the NRP (2000) and the National Early Literacy Panel (2008). However, there has been general agreement that the quality and quantity of literacy experiences in both print and Braille must improve (Erickson & Hatton, 2007a, 2007b; McCall et al., 2011; Murphy et al., 2008; Parker & Pogrund, 2009; Wormsley & D'Andrea, 2000). Recommended practices for students of school age have included repeated readings, direct instruction in phonics, decoding morphemes, and exposure to a wide variety of reading genres (Erickson & Hatton, 2007a, 2007b; Legge, Madison, & Mansfield, 1999; McCall et al., 2011). Recent research has indicated that instruction in vocabulary requires more attention as students grow older (Wall Emerson, Holbrook, & D'Andrea, 2009). Holbrook and Spungin (2009) recommended continual monitoring of children's literacy achievement. As children mature over time, (a) the disparity in reading rates between children with and without visual impairments appears to grow wider (Corn et al., 2002), and (b) some researchers believe the increasing disparity is related to the level of visual acuity, with children who are blind falling further behind (Erickson & Hatton, 2007a, 2007b; Krischer & Meissen, 1983).

Braille awareness begins as early as possible. Erickson and Hatton (2007a) considered *readiness*, the concept that children must display certain prerequisite behaviors before being introduced to Braille or print, to be a myth. Erickson and Hatton (2007a, 2007b) and Legge and

colleagues (1999) suggested that age at introduction of Braille is correlated to faster Braille reading speed at school age. Limited evidence shows that both print and Braille experiences for infants and toddlers are best integrated into meaningful interactions with familiar adults (Erickson & Hatton, 2007a, 2007b) and that children themselves will indicate a preference for or demonstrate an efficiency with one modality as they mature (McCall et al., 2011). Working as a team, teachers and families of students with visual impairments can support language and concept development while giving attention to sensory input (Erickson, Hatton, Roy, Fox, & Renne, 2007). Koenig and Holbrook (2000c) and Murphy and colleagues (2008) have discussed a variety of early strategies.

Print readers. For students who are print readers, there is strong evidence that training in and use of low-vision devices increases oral comprehension, oral and silent reading speed, and the amount of total reading accomplished (Corn, Wall, & Bell, 2000; Corn et al., 2002; Erickson & Hatton, 2007a, 2007b; Farmer & Morse, 2007; Ferrell, Dozier, & Monson, 2011; Ferrell, Mason, Young, & Cooney, 2006; Helnsley, 1986; Howell, 1980; Jose & Watson, 1978; Lackey, Efron, & Rowls, 1982; La Grow, 1981; Lusk, 2012; Rossi, 1980; Schwartzenberg, Merin, Nawratzki, & Yanko, 1988; J. K. Smith & Erin, 2002). Older studies indicated that large print resulted in better overall performance in terms of reading rates, reading accuracy, and comprehension (Bock, 1971; Sykes, 1971). However, teaching children to use low-vision devices and other technology has been shown to provide optimal access to print (Corn & Koenig, 2002; Douglas et al., 2011; Lussenhop & Corn, 2002; H. Mason, 1999; H. Mason, McCall, Arter, McLinden, & Stone, 1997). Magnifying technology is generally considered more effective than hard-copy enlarged print (Corn & Koenig, 2002; Douglas et al., 2011; H. Mason et al., 1997). Students who read print have been found to require regular and intensive assessment and intervention from trained and certified personnel in the effective use of functional-vision and low-vision devices (Bock, 1971; Cobb, 2008; Corn & Koenig,

2002; Douglas et al., 2011; Lussenhop & Corn, 2002; H. Mason, 1999; H. Mason et al., 1997; Sykes, 1971). Bosman, Gompel, Vervloed, and van Bon (2006) found that low vision affects the reading process quantitatively and not qualitatively. In addition, other studies have shown that a student whose visual condition incorporates a central visual-field defect requires greater support for early decoding skills (Erickson & Hatton, 2007a, 2007b; Gompel, Janssen, van Bon, & Schreuer, 2003; Legge, Rubin, Pelli, & Schleske, 1985; van Bon, Adriaansen, Gompel, & Kouwenberg, 2000). Another study by Douglas, Grimley, McLinden, and Watson (2004) suggested that low-vision readers may have a different reading strategy than children without visual impairments, although Corley and Pring (1993a, 1993b) concluded that low-vision readers resembled younger readers without visual impairments.

Braille readers. Daily literacy instruction for young Braille readers is essential (Koenig & Holbrook, 2000a). Braille instruction must be systematic, regular, adequate to the child's needs, and provided by knowledgeable and appropriately trained personnel to give the child who is blind the best opportunity to become a proficient reader (Barclay, Herlich, & Sacks, 2010; Koenig & Holbrook, 2000a; Lusk & Corn, 2006; Musgrove & Yudin, 2013; U.S. Department of Education, 2000; Wall Emerson, Sitar, et al., 2009). Strong evidence suggests that reading instruction within a structured format, including drill and practice in Braille reading, results in increased reading achievement, faster silent and oral reading rates, fewer reading errors, and greater comprehension (Crandell & Wallace, 1974; Ferrell, Mason, et al., 2006; Flanagan, 1966; Flanagan & Joslin, 1969; Kederis, Nolan, & Morris, 1967; Layton & Koenig, 1998; Lorimer, 1990; Mangold,1978; McBride, 1974; M. R. Olson, 1977; Wall Emerson, Holbrook, et al., 2009).

Recent research has indicated that introduction of Braille contractions as children naturally encounter them is associated with higher literacy performance as children mature (Wall Emerson,

Holbrook, et al., 2009). Similarly, spelling accuracy is also associated with early introduction of Braille contractions, increased reading experience, and orthographic knowledge (Arter & Mason, 1994; Corley & Pring, 1993c; Erickson & Hatton, 2007a, 2007b; Gompel, van Bon, Schreuder, & Adriaansen, 2002; van Bon et al., 2000). Two-handed approaches to Braille reading seem to be associated with greater reading speed and accuracy (L. K. Mason, 2012; Wright, Wormsley, & Kamei-Hannen, 2009). For some Braille readers, audiobooks can be an efficient reading medium for some types of literacy genres. This seems to be more effective when the student can control the rate of speed (Esteves, 2007; R. M. Jackson, 2012; Lesnick, 2006).

There is strong evidence that (a) low-vision devices can increase reading speed and comprehension, and (b) drill and practice in the Braille code results in greater reading fluency and comprehension. There are several studies that have used correlational research designs that have linked Braille literacy to adult employment, thus providing a moderate level of evidence. Other recommendations are supported by emerging and limited levels of evidence, given their reliance on expert opinions and systematic reviews of the literature. Intervention studies that seek to identify the most effective instructional strategies are surprisingly sparse, but collaborative studies like the ABC Braille Study (Barclay et al., 2010) are a promising trend.

Mathematics

Mean percentile scores for school-age students with visual impairments participating in SEELS were 41.3 (n = 232) for applied problems and 45.6 (n = 233) for calculation (Marder, 2006). Similarly, NLTS2 (2003) determined that secondary-age students with visual impairments achieved mean percentile scores on the Woodcock-Johnson III subtests for mathematics applied problems and calculation (Woodcock, McGrew, & Mather, 2001) of 32.3 (n = 317) and 42.2 (n = 416) respectively (Wagner, Newman, Cameto, & Levine, 2006). These percentile scores, which are

among the highest for all students with disabilities, are misleading because more than half of the sample of students with visual impairments participating in these two studies was omitted from the standardized assessments (i.e., NLTS2). Some students with visual impairments seem to do well in mathematics, but a significant proportion, both with and without additional disabilities, does not.

Research into effective mathematics interventions for students who are blind or have low vision is sparse. An *educational intervention* is defined as a systematic application of a program, product, practice, or policy with the intent of affecting an outcome. A meta-analysis in 2006 found only 125 articles, theses, and dissertations related to mathematics, with only 10 meeting the criteria of an educational intervention and an appropriate control or comparison group (Ferrell, Buettel, Sebald, & Pearson, 2006). These 10 studies included from three to 79 student participants who attended either regular public schools or specialized schools for students with visual impairments. Participants' grades ranged from primary through secondary. There was great variation in the ages and grade levels of the students who participated in these studies, making generalizations to the larger population of children with visual and/or multiple impairments difficult. The interventions and outcomes reported were unique to each study. Only four of these studies meet the What Works Clearinghouse (WWW, 2013) evidence standards.

For more than 40 years, concrete materials have been recommended for teaching students with visual impairments (Lowenfeld, 1973; Koenig & Holbrook, 2000b). Belcastro (1993), Champion (1976/77), and Hatlen (1975) demonstrated that concrete mathematics aids can increase computation accuracy; the three studies also demonstrated that aids and devices increase the acquisition of mathematics skills. The talking calculator Champion (1976/77) investigated is not generally considered a concrete material, and Kapperman, Heinze, and Sticken (2000) recommended against its use until mathematics skills are mastered. Indeed, a wide variety of

computational aids, such as the cubarithm slate; Braille, large print, and stick-on number lines; various other manipulatives; and the new talking graphing calculator, are available from the American Printing House for the Blind. These devices are useful to demonstrate math concepts in a tactual manner and provide independent feedback to students through the medium of speech. Finger math, or Chisanbop, was shown to increase mathematics skills in three students who read Braille (Maddux, Cates, & Sowell, 1984)

The Cranmer abacus, an adaptation of the traditional Asian calculation tool with a different arrangement of counting beads and a back that keeps the beads in place, is often used to teach calculation skills to students with visual impairments. In fact, more than half of teachers responding to a survey about abacus instruction reported that they were currently teaching abacus to children with visual impairments (Amato, Hong, & Rosenblum, 2013; Rosenblum, Hong, & Amato, 2013), and most began instruction sometime between preschool and second grade. This study also documented multiple instructional methods and pointed out that more research is needed. Nolan and Morris (1964), who documented an increase in achievement scores in mathematics after training with the abacus, supported the use of the Cranmer abacus as an instructional tool. Kapperman (1974), however, found that Braille and mental calculation were more accurate than use of the abacus. No additional studies have been conducted. Although a position paper by the American Printing House for the Blind (Terlau & Gissoni, 2012) promoted the abacus as equivalent to pencil-and-paper calculation, the evidence for instruction in the abacus must be considered limited.

Despite documented lower achievement scores in mathematics for students with visual impairments, research investigating effective intervention strategies is woefully absent. There is limited evidence that mathematics comprehension is facilitated by the use of concrete aids and

devices. The Cranmer abacus, a device that appears to be widely taught, also has limited conflicting evidence supporting its use.

Placement/Inclusion

More than half (i.e., 53%) of elementary and middle school students with visual impairments receive their education in general education classrooms; almost one third (i.e., 29%) attend special education classes in regular schools; and about one fifth (i.e., 19%) attend specialized schools (Marder, 2009). The amount of time spent in general education settings appears to be associated with the degree of visual impairment and the presence of cognitive impairments (Marder, 2006). Students with visual impairments without cognitive impairments are more likely to attend general education classes (i.e., 65% of the sample) and are less likely to attend special education classes in regular schools (i.e., 19%), but those with cognitive impairments are less likely to attend general education classes (i.e., 3%) and more likely to attend special education classes (i.e., 47%; Marder, 2006). Far more students with visual impairments and cognitive impairments attend special schools (i.e., 50%) than do those without cognitive impairments (i.e., 16%; Marder, 2006).

Research on the performance of students with visual impairments based on educational setting has not been conducted. Douglas and colleagues (2011) found no empirical evidence that supported a particular placement as being superior to any other placement. IDEA (2004) required a continuum of placement options, and both OSEP at the U.S. Department of Education (2000) in *Policy Guidance* and NASDSE in *Educational Service Guidelines* (Pugh & Erin, 1999) supported the utilization of a variety of placement options depending on child needs as determined by the IEP team. This practice is also supported by the professional literature—including most notably Hazekamp and Huebner (1989), Huebner, Garber, and Wormsley, 2006, and Huebner and

colleagues (2004)—and by parents and advocates for students with visual impairments (Crane, Cuthbertson, Ferrell, & Scherb, 1997; LaVenture, 2007).

The issue of placement is confounded by issues of heterogeneous child characteristics, economic issues, and local capacity to provide the educational services that a child with visual impairment may need. This is a field that for more than 50 years has included children in general education classrooms, yet the literature is replete with theoretical statements for and against inclusion of students with visual impairments based more on personal philosophy than research evidence. We have the means to investigate the effects of various placements but apparently lack the will to do so.

Science

Given the numerous articles regarding science instruction and how to adapt instruction for students with visual impairments, little intervention research has been conducted. The literature focuses on the development of models and curricula, following the same principles for accommodations and modifications noted elsewhere (Dion, Hoffman, & Matter, 2000; Erwin, Perkins, Ayala, Fine, & Rubin, 2001; Gough, 1978; Hadary & Cohen, 1978; Koenig & Holbrook, 2000b; Kumar, Ramassamy, & Stefanich, 2001; Linn & Their, 1975; Long, 1973; Struve, Their, Hadary, & Linn, 1975; Waskoskie, 1980; Wild & Allen, 2009; Willoughby & Duffy, 1989). The level of evidence for instruction in science is emerging.

Social-Emotional/Behavior

Social-emotional behavior of students with visual impairments does not appear to deviate from the behavior of students without disabilities. Most literature focuses on interaction with peers and adults (Erwin, 1993); self-esteem (Tuttle & Tuttle, 2004); and teaching the everyday social skills that are not possible to acquire through visual cues (Sacks & Wolffe, 2006). A limited level

of evidence supports the use of self-evaluation and feedback to assist students in maintaining and generalizing social skills to new situations (Jindal-Snape, 2004, 2005a, 2005b; Jindal-Snape, Kato, & Maekawa, 1998). Interaction with peers in neighborhoods, classrooms, and playgrounds can be mediated by adults, but it is generally agreed upon that social skills must be deliberately taught in order to facilitate and sustain entry into multiple types of social groups (Celeste, 2006; Erwin, 1993; J. S. Hodges & Keller, 1999; Jindal-Snape, 2004; Kekelis, 1992; MacCuspie, 1996; McGaha & Farran, 2001; Peavey & Leff, 2002; Rosenblum, 1998; van Hasselt, Herzen, Moor, & Simon, 1986). Thus, the evidence for this category is moderate in terms of the need for specifically taught skills to mediate the social environment, but the actual interventions to accomplish this have been investigated by a limited number of researchers.

Transition

Transition, an important topic within the education of students with visual impairments, has not been widely researched. Administrative guidelines (Pugh & Erin, 1999) and *Policy Guidance* from the U.S. Department of Education (2000) viewed transition as an important part of the secondary curriculum. Wolffe and Kelly (2011) found a positive relationship between career education and intervention in social skills during secondary school years with employment following graduation for youths participating in the NLTS 2. However, the rate of employment of adults with visual impairments nationally remains low. Bell (2010) estimated that only 37% of legally blind adults exiting the vocational rehabilitation system secured employment. Bell and Mino (2013) estimated that only 31.3% of adults with visual impairments of working age (ages 18 to 64) were currently employed.

McDonnall and colleagues (McDonnall, 2010, 2011; McDonnall & Crudden, 2009; McDonnall & O'Mally, 2012) have studied the factors that affect employment and found early

work experiences (e.g., finding a job, holding many jobs for longer periods of time) during secondary school to be a prime factor. Interestingly, school-sponsored work experiences were not predictive of postschool employment (McDonnall, 2010, 2011). In addition to work experience, McDonnall (2010) identified other predictors in related studies such as mathematics and verbal aptitude, parental support, and self-reported health as well as completion of a postsecondary program, independent travel skills, and social skills (McDonnall, 2011). McDonnall and Crudden (2009), in a study of youths served in the vocational rehabilitation system, also identified academic competence, self-determination, use of AT, and locus of control as being associated with employment. In a multivariate analysis of the NLTS 2, Monson (2009) similarly determined that independent living skills and self-determination skills were associated with a higher postschool quality of life.

Cavenaugh and Giesen (2012), in a review of the literature, were unable to identify transition interventions that directly resulted in employment, although many interventions studied targeted behaviors that would seem to improve employability such as social skills, work experience, other career development activities, and independent living skills. Fields (2004) found that gender (i.e., female), poorer vision, minimal AT use, orientation and mobility skills, and transportation increased chances for postschool employment. On the other hand, Zhou, Smith, Parker, and Griffin-Shirley (2013) found that a high level of computer competence was associated with paid employment.

Administrative guidelines (Pugh & Erin, 1999) and *Policy Guidance* from the U.S. Department of Education (2000) viewed transition as an important part of the secondary curriculum. In addition, Musgrove and Yudin (2013) underscored Braille literacy as an important factor in future employment.

As Cavenaugh and Giesen (2012) pointed out, research in the area of transition is limited. The several studies identifying promising practices primarily utilize correlational and causal-comparative research designs. Furthermore, similar to other research discussed in this paper, replication of research seldom occurs.

Research and expert opinions have identified variables important to quality-of-life transition paradigms but often based only on secondary analyses of large data sets. These variables have never been tested in a prospective intervention study. The fact remains that the rate of employment of blind adults has remained at the same low level for more than 50 years. It would seem that post-hoc analysis does not lead to the right answers.

Conclusion

Scientifically based research in special education for infants, children, and youth with vision loss is difficult because the low prevalence of visual impairment dictates small sample sizes broadly distributed over large geographic areas. This one fact means that research is costly in terms of both travel and time. The heterogeneity of visual impairment results in flawed or inadequate comparison groups such as inappropriate comparisons to students without disabilities. Warren (1994), believing that comparisons to children without disabilities only documented discrepancies and failed to establish cause or lead to an understanding of why or how to intervene, addressed these issues and recommended an individual-differences approach to the study of children with visual impairments.

As we have documented, there is little empirical evidence to support the methodologies and practices used to educate children and youth with visual impairments. Some lines of research, such as instruction in Braille, training in use of low-vision devices, and transition, stand out because they have received more attention than others. Others, such as orientation and mobility instruction for children, placement decisions, determination of individual reading media, and AT, require research.

Taken as a whole, education of infants, children, and youth with visual impairments is characterized by surveys, case studies, correlational research designs, expert opinions, and public policy. There are notable exceptions, but in the absence of funding and specialized research institutes with dedicated researchers, the prognosis is dim for building an evidence base that informs educators and families about what truly is effective practice. The essential components (see Appendix) are supported by quality research, expert opinions, and educational policies. The level of evidence ranges from emerging to strong, but the overall level is limited. For a field with one of the longest histories of providing educational services, this limited level of evidence is shocking and must be improved.

Deafblindness

Deafblindness is the smallest disability group and also the most heterogeneous. Children and young adults differ by type and level of hearing and vision loss, age of onset of vision and hearing loss, physical and health issues, cognitive functioning, expressive and receptive communication forms, and educational histories. Like all learners, children who are deafblind are also diverse by race, ethnicity, culture, family (including language of the family), community characteristics, and socioeconomic status.

Vision and hearing, which are important senses for learning, reinforce each other. Thus, one cannot understand the impact of deafblindness by adding up the effects of the vision loss and the effects of the hearing loss. The effect of deafblindness is multiplicative, not additive. Deafblindness may be congenital or adventitious. Many individuals who are congenitally deafblind will struggle to become linguistic, but most individuals who are adventitiously deafblind will be linguistic. Individuals who are adventitiously deafblind will require extensive supports while learning new communication and literacy forms (e.g., sign language, Braille). Deafblindness

creates serious challenges not only to access, but also to engagement. Little incidental learning occurs due to the loss of distance senses. Touch is an important sense for learning (Silberman, Bruce, & Nelson, 2004). There is evidence for the effectiveness of both child-guided and systematic instructional approaches with children who are congenitally deafblind.

Administration

Each IEP team should include a member who is knowledgeable about the impact of deafblindness and also about specialized communication methods and instructional approaches to assist with assessment, instructional planning, and program implementation (Parker, McGinnity, & Bruce, 2012; Riggio, 2009; Riggio & McLetchie, 2008). Deafblindness is the lowest incidence disability; thus, most educational professionals receive little if any information about how to instruct children who are deafblind. It is insufficient to have team members with expertise only in visual impairment or in hard of hearing/deafness because the impact of deafblindness is far greater than one can surmise from adding the effects of vision and hearing loss. This is because deafblindness involves both distance senses, thus greatly limiting access to others and information, observation, and incidental learning. When a district has no individual with deafblind expertise, the state deafblind project may provide information about technical assistance and PD opportunities. For more information on the competencies required by teachers and paraprofessionals serving children who are deafblind, see McLetchie and Riggio (1997) and Riggio and McLetchie (2001).

Instructional groups must be small enough to allow the child who is deafblind to fully access information, engage in the lesson, and receive feedback (Parker et al., 2012; Riggio, 2009; Riggio & McLetchie, 2008). Even if children have significant residual vision and/or hearing, small groups will support with locating the speaker or communication partner while keeping background sounds and visual clutter to a minimum. Learners who primarily rely on tactual input for learning

may require 1:1 instructional arrangements for most of their lessons to support access and engagement as well as to allow for frequent tactual feedback.

The level of evidence for these administrative recommendations is at the emerging level due to a lack of research to support these practices. Thus, the professional literature written by experts in the field who have classroom and administrative experience must be used as evidence to support these emerging practices until research has been conducted to provide additional evidence.

Assessment

The sole use of standardized assessment instruments is inappropriate for children who are deafblind (C. Nelson, van Dijk, Oster, & McDonnell, 2009; Silberman et al., 2004). This is because standardized instruments seldom include children who are deafblind as a norming group. Additionally, standardized instruments require precise administration procedures that may not allow enough flexibility to accommodate the needs of children who are deafblind during the assessment process. Great caution should be applied while estimating the abilities of children who are deafblind (Geenens, 1999). To identify additional disabilities, the criteria used for children with other disabilities may not be appropriate to apply for assessing deafblind children for an additional disability (Hartshorne, 2011; Johannson, Gillberg, & Rastam, 2010). Many children who are deafblind function differently across environments; thus, effective assessments are conducted across multiple and natural environments (i.e., those known to the child) with input from multiple adults (Chen, Rowland, Stillman, & Mar, 2009; McLetchie, 1995; Stremel & Schutz, 1995). Direct assessment should be conducted by or in the presence of at least one adult who knows the child well (C. Nelson, van Dijk, McDonnell, & Thompson, 2002).

Informal assessment instruments and procedures, including dynamic assessments, are critical to capturing a complete understanding of the child's abilities (Chen et al., 2009; Eyre, 2002;

Holte et al., 2004; C. Nelson, Janssen, Oster, & Jayaraman, 2010). Early childhood assessment should address the identification of the strengths and needs of the child and the family (Chen et al., 2009**)**. Person-centered assessment approaches (a) include input from family, friends, and the individual who is deafblind and (b) support the identification of valued life outcomes and the necessary supports to achieve those outcomes (McNulty, Mascia, Rocchio, & Rothstein, 1995; Romer & Romer, 1995; Schwartz, 1995; Stremel, Perreault, & Welch, 1995; Stremel & Schutz, 1995).

Assessment of children who are deafblind should include functional vision and hearing evaluations to augment information from the audiology and ophthalmology reports as well as an assessment of the child's preferred learning channels as part of a learning media assessment (IDEA, 2004; Koenig & Holbrook, 1995; McKenzie, 2007, 2009b; McLetchie, 1995; Michael & Paul, 1991). The visual, hearing, and tactile characteristics of current and potential future environments must also be assessed so that appropriate adaptations and accommodations can be determined (McLetchie & Riggio, 1997; K. Olson, Miles, & Riggio, 1999).

The level of evidence for all assessment recommendations is at the emerging level due to a lack of research to support these practices.

Assistive Technology

Children and youth who are deafblind need AT, such as alerting devices, to support communication, orientation and mobility, participation in content-area instruction, and life skills. The AT may be low tech (e.g., hand-held magnifier) or high tech (e.g., devices with refreshable Braille displays; Prickett & Welch, 1995). The selection of AT and instruction on its use must be grounded in thorough assessment, including learning media assessment, with the goals of enhancing

access and engagement across all environments and in all areas of the individualized and general curriculum.

There is a well-developed, international body of literature on the outcomes of cochlear implantation in children who are deafblind. Although outcomes are highly variable, studies have shown some patterns across etiologies as well as other predictor variables (Amirsalari et al., 2011; Bauer, Wipold II, Goldin, & Lusk, 2002; Birman, Elliott, & Gibson, 2012; Chute & Evans, 1995; Damen, Penning, Snik, & Mylanus, 2006; Dammeyer, 2008; Edwards, 2007; Hamzavi et al., 2000; Lanson, Green, Rowland, Lalwani, & Waltzman, 2007; Todd, 2011; Wiley et al., 2013). Thus, parents must be informed of the potential risks, benefits, and predictors of outcomes, including etiological and other disability-related predictors.

Parents of children who are deafblind may value cochlear implantation outcomes that are unimportant to parents of children who are deaf alone due to the impact of deafblindness (e.g., isolation, reduced environmental feedback). These parents have provided strong evidence for improvements in attention; interactions with objects; listening, which may break down isolation and enhance engagement; responsiveness; increased awareness of environmental sounds, which may improve safety; and increased vocalizations (Bashinski, Durando, & Thomas, 2010; Chute & Evans, 1995; Damen et al., 2006; Dammeyer, 2008; Liu et al., 2008; Southwell, Bird, & Murray, 2010). Direct instruction of children with cochlear implants and their parents on detecting environmental and speech sounds, among other skills, is essential to maximizing the potential benefits of implantation. Positive outcomes are more likely if the cochlear implant is consistently worn during waking hours, if daily function checks are performed on the implant, and when strategies introduced through direct instruction are practiced (Stremel, 2009).

The outcomes of cochlear implantation are highly variable, and parents of children who are deafblind value non-speech outcomes. Other areas of AT have not been as well researched with this population, resulting in an emerging level of evidence.

Communication

Communication is one of the more developed areas of research in the field of deafblindness. Highly individualized educational interventions to address the development of communication skills should be

- embedded into every activity,
- provided in the context of natural environments, and
- complemented with ample opportunities for social interaction (Goetz, 1995; Goodall & Everson, 1995; McLetchie, 1995; Stremel & Schutz, 1995; Wheeler & Griffin, 1997; White, Garrett, Kearns, & Grisham-Brown, 2003).

Comprehensive communication programming should address

- forms/modes;
- intents/functions;
- content/vocabulary; and
- context, including the establishment of activities and routines, the physical environment, communication partner skills, and pragmatics (Bashinski, 2011; Bruce, 2002; Crook, Miles, & Riggio, 1999a, 1999b; Goodall & Everson, 1995; McKenzie, 2009a; E. K. Miller, Swanson, Steele, Thelin, & Thelin, 2011).

There is research evidence for the efficacy of both child-guided approaches (limited evidence) and systematic instruction for specific outcomes (moderate evidence).

Child-guided approaches. Child-guided approaches, such as the van Dijk Curricular Approach (MacFarland, 1995), have been applied to support overall communication development. Child-guided strategies include establishing trust, responding to the child's interests and communicative attempts, communicating using the child's expressive forms, selecting representations that are salient to the child, using different forms of dialogue, and using coactive techniques (Crook et al., 1999b; L. Hodges, 2002; Horsch & Scheele, 2011; Janssen, Riksen-Walraven, & van Dijk, 2002, 2003a, 2003b, 2004; MacFarland, 1995; C. Nelson et al., 2009; K. Olson et al., 1999; Pease, 2002; Pittroff, 2011; Rodbroe & Souriau, 1999; Silberman et al., 2004; van Dijk, 1965, 1967; Wheeler & Griffin, 1997).

Systematic instructional approaches. Systematic instructional approaches have been effective in increasing the rate and variety of communicative intents/functions that children who are deafblind express (Brady & Bashinski, 2008; Heller, Ware, Allgood, & Castelle, 1994; Schweigert & Rowland, 1992; Sigafoos et al., 2008; Wolf Heller, Allgood, Davis, et al., 1996; Wolf Heller, Allgood, Ware, Arnold, & Castelle, 1996; Wolf Heller, Allgood, Ware, & Castelle, 1996). Whatever approach is used, individualized programming should reflect an understanding of the levels of communicative development and the process of symbolization to ensure that the educational team provides appropriate communication intervention (Bashinski, 2011; Bruce, 2005a, 2005b; Hartmann, 2013; MacFarland, 1995; E. K. Miller et al., 2011; Pittroff, 2011; Rowland, 2011; van Dijk, 1967; Vervloed, van Dijk, Knoors, & van Dijk, 2006).

There is moderate evidence of the effectiveness of tactile approaches and strategies to improve communication in learners who are deafblind (Chen & Downing, 2006; Chen, Downing, & Rodriguez-Gil, 2001; Downing & Chen, 2003; Klein, Chen, & Haney, 2000; Mathy-Laikko et al., 1989; McLetchie & Riggio, 1997; Miles, 2003; Murray-Branch, Udavari-Solner, & Bailey, 1991;

Rowland & Schweigert, 1989, 2000; Rowland, Schweigert, & Prickett, 1995; Sigafoos et al., 2008; Trief, Cascella, & Bruce, 2013). Touch cues are a tactile form of communication. For example, while preparing to put on a child's pair of glasses, the teacher may provide an opportunity for the child to touch the glasses (while explaining what is about to happen) and then provide a touch cue to the child's temple prior to placing the glasses. Many children who are deafblind will require sign language presented in a tactual form. They will all need instructional materials and approaches that are tactual. Miles (2003) explained the importance of hands (including hands serving the function of eyes) to learners who are deafblind.

Tangible representations are a viable communication form for prelinguistic children who are deafblind (Bruce, Trief, & Cascella, 2011; Cascella, Trief, & Bruce, 2012; Murray-Branch et al., 1991; Prickett & Welch, 1998; Rowland, 1990; Rowland & Schweigert, 1989, 2000; Trief, 2007, 2013; Trief, Bruce, & Cascella, 2010; Trief, Bruce, Cascella, & Ivy, 2009; Trief et al., 2013). Tangible representations may be three-dimensional (e.g., object representations) or two-dimensional (e.g., photographs).

There is a limited, although rapidly growing, body of evidence that adult communication partners can use to improve responsiveness, turn taking, attunement, and other communicative skills of children who are deafblind with systematic demonstrations and coaching (Chen et al., 2001; Janssen et al., 2003a, 2003b, 2004; Janssen, Riksen-Walraven, van Dijk, Huisman, & Ruijssenaars, 2011; Janssen, Riksen-Walraven, van Dijk, Ruijssenaars, & Vlaskamp, 2007; McLetchie & Riggio, 1997).

Early Identification and Early Intervention

Identification. Federal regulations do not specify levels of vision or hearing loss for the identification of deafblindness (Chen, 2004). Although there is no mandated newborn screening for

vision loss, the National Academy of Ophthalmology and the National Academy of Optometry recommend that all children receive a vision examination between ages 6 months and 30 months (Chen, 2004). Vision evaluations should include both an ophthalmological evaluation and a functional vision evaluation (Holte, Prickett, Van Dyke, et al., 2006). The provision of newborn hearing screening supports early identification of hearing loss and subsequent referral for early intervention services. Preparing educators of children who are deaf or hard of hearing to recognize signs of possible vision loss, including signs of typical and atypical visual behaviors, becomes one of the strongest mechanisms for identifying deafblindness (Chen, 2004; Murdoch, 2004). The state deafblind projects, funded through OSEP, include a child-find mission. To improve the identification of children who are deafblind, the National Consortium on Deaf-Blindness (NCDB) developed a self-assessment guide to support the projects in early identification and referral (Malloy, Thomas, Schalock, Davis, & Udell, 2009).

Intervention professionals. Early intervention is critical to reducing the profound developmental disadvantages faced by children who are deafblind (Chen, Alsop, & Minor, 2000; Jatana et al., 2013; Michael & Paul, 1991; Murdoch, 2004). Infants and young children who are deafblind are less responsive to caregivers, exhibit few initiations to interact, have few opportunities to learn incidentally due to reduced input from both distance senses, and struggle to develop early concepts (Chen, 2004; Chen & Haney, 1995; Chen, Klein, & Haney, 2007; Holte, Prickett, Glidden, et al., 2006).

The complex and heterogeneous needs of children who are deafblind call for highly specialized and individualized services provided by collaborative teams that recognize the critical role of the family in creating optimal outcomes for the children (Holte, Prickett, Glidden, et al., 2006; Murdoch, 2004; Schwartz & McBride, 1995; Silberman et al., 2004). Caregivers benefit

from preparation in recognizing the child's cues for interaction, resulting in higher levels of adult responsiveness. They also benefit from learning to establish sequenced routines that elicit anticipation in the child and opportunities for adults to contingently respond (Berg, 2006; Chen, Klein, & Minor, 2008; Murdoch, 2004). Intervener services in the home have been found to accelerate the child's development beyond what would be expected due to typical maturation across multiple areas of development, including a marked increase in the frequency and complexity of communication and an associated reduction in the frequency of self-stimulatory behaviors (Watkins, Clark, Strong, & Barringer, 1994).

There is a moderate level of evidence that early intervention services, including those offered in the home, reduce the developmental disadvantages posed by deafblindness.

Life Skills

There is strong evidence that systematic instruction that is grounded in behavioral principles has been effectively applied to improve daily living skills in children and youth who are deafblind. J. K. Luiselli (1988a) evaluated different types of prompting procedures and praise to support the initiation of eating skills. In a second study, J. K. Luiselli (1988b) successfully addressed inappropriate behavior that occurred during eating by using praise and favorite foods to reinforce appropriate behavior and interrupting procedures to address inappropriate behaviors. In a third study, J. K. Luiselli (1993) taught self-feeding to two children who were deafblind using prompting and prompt-fading, reinforcement, and response-interrupting procedures to address carefully defined target behaviors. Lancioni (1980) applied behavioral principles, such as reinforcement and punishment, to teach independent toileting. McKelvey, Sisson, Van Hasselt, and Herson (1992) investigated the effectiveness of teaching the entire sequence of a dressing routine, as opposed to chaining, to one child participant who was deafblind. They delivered instruction, graduated

guidance, and praise during the dressing sequence but tangible reinforcement only upon completion of the sequence. Venn and Wadler (1990) described a 4-year project that applied behavioral principles to address home management, personal, and other skills in four youth who were deafblind within an independent living setting. In these studies, the selection of a well-defined target behavior and careful consideration of prompting and reinforcement levels were important components leading to successful student outcomes. The independent living curriculum developed by Loumiet and Levack (1993) can be adapted for students who are deafblind.

Much of the research evidence on the achievement of life skills by children who are deafblind is in the area of orientation and mobility. Systematic instruction, especially in the context of desirable and functional activities, has been found to result in positive learning outcomes (Lancioni, Bellini, & Oliva, 1993a, 1993b; Lancioni, Bellini, Oliva, Guzzini, & Pirani, 1989; Lancioni, Mantini, Cognini, & Pirani, 1988; Lancioni, Olivia, et al.,1988; Lancioni, Oliva, & Barolini, 1990; Lancioni, Oliva, & Bracalente, 1994; Lancioni, Oliva, & O'Reilly, 1997; Lancioni, Oliva, & Raimondi, 1992; Lancioni, O'Reilly, & Campodonico, 2000; Lancioni, O'Reilly, Campodonico, & Mantini, 1998; Lancioni et al., 2007; Parker, 2009).

There is a critical shortage of COMS with specialized preparation in deafblindness (Huebner & Kirchner, 1995). Orientation and mobility instruction for students who are deafblind must be modified to reflect the impact of deafblindness, potential balance issues, and unique and complex communication needs (Huebner & Prickett, 1996; Joffee, 1995; Joffee & Rikhye, 1991; Lolli, Sauerburger, & Bourquin, 2010). COMS must consider the experiential background of each individual who is deafblind because of the reduction in incidental learning due to deafblindness (Silberman et al., 2004). Some etiologies (e.g., CHARGE syndrome, Usher Syndrome Type 1) are associated with more pronounced issues with balance (Haibach, 2011; Lolli et al., 2010; Thelin,

Curtis, Maddox, & Travis, 2011). Many individuals who are deafblind will not have sufficient hearing to access the speech of COMS. Thus, they may require the services of a sign language interpreter who may communicate in either visual or tactual sign language. The use of an interpreter will lengthen each lesson because travel and communication must sequentially occur. Youth who are deafblind also require specialized instruction for interacting with the public. COMS must modify the orientation and mobility curriculum and instructional techniques and the selection of devices for children and youth who are deafblind. For example, street-crossing techniques used with individuals who are deafblind are significantly different from street-crossing techniques used for those who are visually impaired. Devices that convert sounds to vibro-tactile output may be incorporated into travel.

Children who are deafblind have fewer opportunities to engage in physical activity (Lieberman & Houston-Wilson, 1999; Lieberman & MacVicar, 2003). Due to the need to communicate in close physical proximity, most individuals who are deafblind cannot simultaneously communicate while engaging in physical activity. Thus, adults who support participation in physical education and leisure and recreation activities must carefully sequence these activities with breaks for communication as part of instruction (Arndt, Lieberman, & Pucci, 2004).

There is a strong level of evidence about the effectiveness of systematic instructional approaches within the daily living skill domain. This has also been shown to be of importance to participation in physical activities that must embed carefully constructed opportunities for communication. Within the area of orientation and mobility, there is a moderate level of evidence for the importance of systematic instruction and a limited level of evidence for the importance of specialized instructional techniques for individuals who are deafblind.

Literacy

The traditional view of literacy as reading and writing has been challenged in recent years because it excludes learners who are prelinguistic. A new, more inclusive view of literacy includes all learners (McKenzie & Davidson, 2007; Miles, 2005), begins at birth (Parker & Pogrund, 2009), and recognizes that the materials and media of literacy differ across learners. Literacy that is experienced through technology, such as speech-generating devices, is often called the *new literacy* (Emerson & Bishop, 2012).

Contemporary definitions of literacy view communication as supportive or part of literacy (McKenzie & Davidson, 2007). Daily schedules, story boxes, experience books, choice-making opportunities, and interactive home-school journals are among the literacy lessons of importance to prelinguistic learners who are deafblind (Blaha, 2001, 2002; Bruce & Conlon, 2005; Bruce, Randall, & Birge, 2008; Crook & Miles, 1999; MacFarland, 1995; Swanson, 2011).

Daily schedules. Also known as anticipation shelves or calendar systems, daily schedules are important to learning one's routine, representations for activities within the routine, and left-to-right sequencing. Each trip to the daily schedule provides an opportunity for a conversation.

Story boxes. Story boxes are collections of objects that relate to an experience or a book. While reading a story, the teacher may stop and allow time for the child to handle the objects, name the objects, or use the objects to respond to questions about the text.

Experience books. Known also as memory books, experience books are about the child's personal experiences, are grounded in the child's perspective, and are physically co-constructed with the child. For example, the child and teacher may gather items from the park and then co-construct a book about that experience, attaching one object to each page and then labeling in print and perhaps in Braille what it represents (for consistent reading by adults). While reading

experience books, it is important to allow ample time for conversation to occur about each page (Bruce et al., 2008).

Choice-making opportunities. Making choices is an important aspect of literacy development (K. Olson et al., 1999). Authentic choice making only occurs if the child understands the representations, understands the choice-making process, and has true preferences from among the options displayed.

Home-school journal. The home-school interactive journal replaces the typical notes shared between parents and school staff. Each journal may be only a few pages long with each page representing an important activity experienced by the child that day (Bruce & Conlon, 2005). This lesson builds memory and distancing, which are important to symbolic development.

All learners benefit from a literacy-rich environment (McKenzie, 2009a). This environment may include, among other materials,

- books in print, Braille, and auditory formats;
- tactile books,
- labels,
- interactive software paired with ample opportunities to communicate, and
- commercially produced books with appropriate tactile adaptations.

Learners who are deafblind require ample hands-on experiences to ensure that they understand the concepts expressed in books (Miles, 2005). This is because they have few, if any, opportunities to incidentally gain information by listening or observing. The van Dijk Curricular Approach includes sequential memory strategies and symbolic instructional strategies to support literacy development through a child-guided approach (MacFarland, 1995). McLetchie and Riggio (1997) articulated the competencies required by teachers in the area of communication for prelinguistic and linguistic

learners. The Paths to Literacy (2014) website (www.pathstoliteracy.org) and Project Salute (2002-2005) website (www.projectsalute.net) are additional resources on literacy development for children who are deafblind.

Most research studies on literacy instruction for children who are deafblind are descriptive studies; thus, evidence is emerging. There is a need for intervention studies that investigate effective instructional approaches and strategies in literacy. Because contemporary views of literacy include expressive and receptive communication, the narrative and essential components in the area of communication should be considered as an important complement to this area.

Mathematics

A review of the literature revealed no studies or peer-reviewed articles on teaching mathematics to children who are deafblind. Suggestions from the field of visual impairment are relevant to addressing some of the needs of learners who are deafblind. Kapperman and colleagues (2000) suggested that teachers, while planning instruction in mathematics, consider

- the child's background knowledge and experiences in relationship to key concepts of the lesson,
- the vocabulary demands of the lesson,
- the need for content modifications,
- the selection of manipulatives to illustrate key concepts and aid in computation, and
- the adaptations that encourage active engagement in the lesson.

They also suggest that teachers be mindful of the need for consistent use of mathematical vocabulary such as terms for different operations and symbols. Because children who are deafblind use multiple receptive and expressive communication forms (e.g., verbalizations, sign language, photographs, line drawings, object representations), vocabulary must be expressed in the forms that

are suitable for each child. When developmentally appropriate, children who are deafblind will require instruction on how to use the abacus, the Braille writer, and mental math for computation. There is a dire need for the field of deafblindness to produce research studies in the area of mathematics.

Placement/Inclusion

It is critical that any placement of choice offers the child who is deafblind opportunities to be an active participant in the general education curriculum and social interactions within the classroom. IDEA (2004) established the requirement to select the least restrictive environment for placement. A variety of placements is needed to address the diverse needs of this highly heterogeneous group of learners. Educational teams across all types of placements will benefit from the support of a deafblind specialist. Across placements, learners will require individualized communication supports, which may include paraprofessionals, interpreters, interveners, and COMS with specialized preparation in deafblindness (Riggo, 2009). Low adult-to-student ratios are essential to supporting access and engagement in any placement (Parker et al., 2012).

Collaborative teaming is essential to successful inclusive educational programming (Cloninger & Giangreco, 1995; Goetz, 1995; Romer & Byrne, 1995). No single person can know all that is needed to address the very complex needs of a child who is deafblind. In collaborative teaming, professionals share their expertise, teach others some aspects of their expertise, and engage in role release (Downing & Eichinger, 2011). In the inclusive setting, the individual with deafblind expertise is likely to be a consultant, a paraprofessional with special training in deafblindness, or an intervener. Interveners supplement the instruction provided by teachers and related service professionals by providing experiences to support the child to comprehend and engage in the curriculum. The intervener supports interactions between the child who is deafblind,

general and special education teachers, and other children, with some also serving as sign language interpreters (Alsop, 2004; Alsop et al., 2010; J. Olson, 2004; Silberman et al., 2004; Watkins et al., 1994). Riggio and McLetchie (2001) detailed the specialized preparation needed by paraprofessionals serving children who are deafblind. Even when an interpreter or specially trained paraprofessional is on the educational team, the general education classroom teacher should create opportunities to directly interact with the child who is deafblind. This is important for creating a truly inclusive environment that communicates that all children are worthy of the teacher's attention and instruction. When no team member with deafblind expertise exists within a school district, the state deafblind project should be contacted for advice about technical assistance.

Adults should support reciprocal interactions between children who are deafblind and their peers without disabilities by addressing environmental barriers to communication (Moller & Danermark, 2007); creating sustained opportunities for interaction; and providing direct instruction of interaction strategies (Downing & Eichinger, 2011; Goetz & O'Farrell, 1999; P. Hunt, Alwell, Farron-Davis, & Goetz, 1996; Ingraham, Daugherty, & Gorrafa, 1995; T. E. Luiselli, J. K. Luiselli, DeCaluwe, & Jacobs, 1995; Prickett & Welch, 1998; Romer & Haring, 1994). This will include teaching others to express in non-speech forms such as gestures or object representations (Correa-Torres, 2008).

Access, participation, and progress in the general curriculum can be enhanced through the proactive application of three Universal Design for Learning (UDL) principles, which are

- multiple means of representation,
- multiple means of action and expression, and
- multiple means of engagement (Hartmann, 2011; R. M. Jackson, 2005).

As a lesson or unit is being developed, educational team members should ensure that information will be presented in an accessible and comprehensible format, that the child who is deafblind has opportunities to demonstrate knowledge and skills, and that necessary adaptations and accommodations are provided to ensure engagement. Additional instructional time may be needed to provide hands-on experiences for tactual learners.

The heterogeneity among children who are deafblind, coupled with the heterogeneity among placements, makes it inappropriate to compare the effectiveness of one setting with another setting. Thus, the recommendations made here are at the emerging level of evidence. Research on effective instructional practices is needed.

Science

Penrod, Haley, and Matheson (2005) reported low test scores in science on the state content test in Kentucky among learners who were blind, deaf, and deafblind, suggesting that gaps in teacher knowledge may be part of this student achievement problem. They further suggested that general education teachers who possess content knowledge in science learn more about sensory disabilities and that teachers of students with sensory disabilities, including deafblindness, learn more about the content area of science. The active engagement of students who are deafblind can be enhanced by making science lessons as inquiry based as possible (Perkins School for the Blind, 2013; Ross & Robinson, 2000). The acquisition of science concepts can be improved through hands-on experiences in problem-solving situations. Given that science is typically taught in a visual format, the teacher with expertise in visual impairment and blindness or deafblindness is needed to suggest tactile adaptations and strategies (Penrod et al., 2005). While preparing to teach each science lesson, teachers must consider the students' backgrounds and experiential knowledge, the vocabulary demands of the lesson, potential content modifications, the adaptations needed to

maximize access to the instruction and materials, and ways to encourage active participation in the lesson (Engelbrecht & Fraser, 2010; Penrod et al., 2005; Ross & Robinson, 2000). Special attention must be given to non-visual means of presenting the science content and the unique communication needs of each student who is deafblind. With just one peer-reviewed article on science instruction, the field of deafblindness is in dire need of research in the area of science.

Social-Emotional/Behavior

There is a moderate level of evidence on the impact of deafblindness on behavior as well as etiologically specific effects on behavior (Bernstein & Denno, 2000; Dammeyer, 2012; Graham, Rosner, Dykens, & Visootsak, 2000; Hartshorne, 2011; Hartshorne & Cypher, 2004; Hartshorne, Hefner, & Davenport, 2000; Hartshorne, Nicholas, Grialou, & Russ, 2007; Hartshorne & Salem-Hartshorne, 2011; J. K. Luiselli & Greenridge, 1982; Stratton & Hartshorne, 2011; van Dijk & deKort, 2005). Although there is an extensive body of research on the importance of identifying the intended purpose or function of a behavior prior to developing an intervention plan, evidence in the field of deafblindness is at the emerging level (Aitken, 2002; Durand & Kishi, 1987; Goetz, 1995; Goodall & Everson, 1995; Hartshorne et al., 2000; Horner & Day, 1991; Janssen et al., 2004; Majors, 2011; Mirenda, 1997; Prickett & Welch, 1998; Silberman et al., 2004; Stremel & Schutz, 1995). The process of identifying the purpose of behaviors is called functional behavioral assessment (FBA). It is important to consider the communicative value of unacceptable behaviors and that these behaviors may occur due to unmet needs (Prickett & Welch, 1998). FBA may be followed by functional communication training (FCT), which involves teaching socially acceptable ways of communicating as replacement behaviors to fulfill the same purposes as unacceptable behaviors.

There is also a moderate level of evidence for the efficacy of applying behavioral principles such as

- praise and attention,
- token economies,
- overcorrection,
- differential reinforcement of other behaviors,
- differential reinforcement of lower rates of behavior,
- response blocking,
- various reinforcement systems, and
- contingency awareness

to reduce or eliminate stereotypes, self-injurious behaviors, and aggression toward others (Barton & La Grow, 1983; Barton, Meston, & Barton, 1984; Horner & Day, 1991; J. K. Luiselli, 1992; J. K. Luiselli, Evans, & Boyce, 1986; J. K. Luiselli & Greenidge, 1982; J. K. Luiselli, Myles, Evans, & Boyce, 1985; Sisson, Hersen, & Van Hasselt, 1993; Sisson, Van Hasselt, & Hersen, 1993; Yarnall & Dodgion-Ensor, 1980). Changes in the curriculum and environment (including stimulation levels) and adult responses can also support positive change in behavior in children who are deafblind (Bernstein & Denno, 2000; Durand & Kishi, 1987; van Dijk & de Kort, 2005). Examples include modifying the curriculum to include experiences that are familiar to the child, providing sufficient physical space to reduce anxiety, and avoiding words that tend to upset the child.

There is a moderate level of evidence for both the impact of deafblindness on behavior and the application of behavioral principles in interventions. Additional research is needed on the application of FBA principles to behavioral assessment in children who are deafblind and proactive strategies that support positive behavior and socialization.

Transition

An interagency approach to personal-futures planning (PFP), a type of person-centered planning, is critical to (a) capturing the transition strengths and needs of each individual who is deafblind and (b) planning natural and paid supports for all aspects of adult living (Everson, 1995; Malloy, McGinnity, Kenlye, Vellia, & Voelker, 2009; B. Nelson, 2005; Rachal, 1995; Rachal, Steveley, Goehl, & Robertson, 2002-2003). PFP involves the creation of maps by a team of concerned individuals and the young adult who is deafblind. A PFP facilitator supports all team members to contribute. PFP maps may be about vocational options, residential options, community involvement, friendships, and other relevant topics for adulthood (Enos, 1995). One of the purposes of PFP is to engage in team problem solving to resolve physical and social barriers to participation across adult settings (Stremel & Schutz, 1995). Extensive documentation of the use of PFP has been made available to a national transition project led by the Helen Keller National Center in the 1990s (S. B. Marks & Feeley, 1995).

Children who are deafblind are more likely to gain employment after high school if provided with vocational experiences that are part of secondary education programming (Luft, Rumrill, Snyder, & Hennessey, 2001; McDonnall & O'Mally, 2012; Petroff, 2010). Employment opportunities should be based on the young adult's preferences among occupations available in their local community. There is a dire need for additional research on all topics related to the transition needs and experiences of young adults who are deafblind.

Conclusion

Vision and hearing are the two distance senses that are most often used for learning. It is difficult to imagine how much hearing and sighted individuals learn through these senses without any special effort. In contrast, individuals who are deafblind gain limited to no benefit from

observational learning. Much of what they learn must be directly taught. Appropriately prepared professionals are essential to addressing the complex programming needs of children who are deafblind (Parker et al., 2012). These professionals extend the invitation to learn and provide the specialized approaches and strategies that support the child's achievement and well-being. Administrative support is critical to providing the types of educational environments that ensure active engagement.

In considering the levels of research evidence on topics in deafblindness, there is a dire need for research in the content areas of literacy, science, and mathematics. There is also a high level of need for further research in assessment, AT, communication, and specialized orientation and mobility techniques. It is important to keep in mind that the heterogeneity of the population of children and young adults who are deafblind makes it very difficult to generalize from a sample to the population. Therefore, researchers must provide detailed descriptions of their study participants so that practitioners will know if the findings are relevant to their students.

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Appendix

Innovation Configuration for Evidence-Based Practices for Students With Sensory Impairments

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
	There is no evidence that the component is included in the syllabus, or the syllabus only mentions the component.	Must contain at least one of the following: reading, test, lecture/presentation, discussion, modeling/ demonstration, or quiz.	Must contain at least one item from Level 1, plus at least one of the following: observation, project/activity, case study, or lesson plan study.	Must contain at least one item from Level 1 as well as at least one item from Level 2, plus at least one of the following: tutoring, small group student teaching, or whole group internship.	Rate each item as the number of the highest variation receiving an X under it.
1.0 Deaf or Hard of Hearing - Administration					
1.1 - Students who are deaf or hard of hearing receive services from professionals knowledgeable about the potential impact of a hearing loss on their development and the family. 1.2 - Students who are deaf or hard of hearing receive services from professionals knowledgeable about their cultural and linguistic needs. 1.3 - Students who are deaf or hard of hearing with additional disabilities receive services from professionals knowledgeable about their educational needs. 1.4 - Students who are deaf or hard of hearing receive services from professionals					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
	There is no evidence that the component is included in the syllabus, or the syllabus only mentions the component.	Must contain at least one of the following: reading, test, lecture/presentation, discussion, modeling/ demonstration, or quiz.	Must contain at least one item from Level 1, plus at least one of the following: observation, project/activity, case study, or lesson plan study.	Must contain at least one item from Level 1 as well as at least one item from Level 2, plus at least one of the following: tutoring, small group student teaching, or whole group internship.	Rate each item as the number of the highest variation receiving an X under it.
1.0 Deaf or Hard of Hearing - Administration					
who respect the preferences of parents/caregivers regarding placement. 1.5 - Students who are deaf or hard of hearing receive services from licensed/certified professionals, including individuals who are deaf or hard of hearing and individuals who from diverse ethnic, cultural, and linguistic backgrounds. 1.6 - The communication, academic, and social performance of students who are deaf or hard of hearing is systematically monitored.					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
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2.0 Deaf or Hard of Hearing - Assessment					
2.1 - Students who are deaf or hard of hearing sometimes master the academic content; however, their ability to demonstrate academic performance may be compromised in some way because of communication, language, reading, and writing delays. 2.2 - Norm-referenced tests often cause problems for students who are deaf or hard of hearing because the tests require reading ability, even while assessing skills other than reading. 2.3 - Systematic error, which is also referred to as bias, can limit the validity of a test and negatively affect the accuracy of the results of assessments with students who are deaf or hard of hearing. 2.4 - Students who are deaf or hard of hearing receive services from professionals					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
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2.0 Deaf or Hard of Hearing - Assessment					
who are knowledgeable about the differences between accommodations and modifications. 2.5 - Educational interpreters who are used during the assessment process are skilled in the sign language or system the student uses to communicate, is familiar with the assessment process or instrument, and understands the importance of confidentiality. 2.6 - Professionals assessing students who are deaf or hard of hearing use a combination of procedures and instruments and avoid relying on a single test or process.					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
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3.0 Deaf or Hard of Hearing - Assisstive Technology					
3.1 - Professionals working with families of children who are deaf or hard of hearing help families obtain as much accurate and accessible information as possible so that they can make informed choices. 3.2 - Professionals working with students who are deaf or hard of hearing collect data about students' functioning using assistive technology (AT) so that they can respond when students' needs change over time or when expected outcomes are not achieved. 3.3 - Students who are deaf or hard of hearing with AT receive ongoing monitoring and support in order to be successful in multiple environments.					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
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4.0 Deaf or Hard of Hearing - Communication					
4.1 - Professionals serving families of children who are deaf or hard of hearing understand that making a decision about which communication approach to use with their child is stressful for hearing parents. Communication types include spoken English, American Sign Language (ASL), a sign system, and simultaneous communication. Although controversy exists about choosing one method (e.g., spoken English, ASL, a sign system, simultaneous communication) rather than another, no approach has been demonstrated to be more effective than others. 4.2 - Professionals serving families of children who are deaf or hard of hearing understand that the quality of communication at home between parents and their children with a hearing loss correlates with children's early socio-emotional and language development					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
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4.0 Deaf or Hard of Hearing - Communication					
as well as with later quality-of-life outcomes. 4.3 - Professionals serving families of children who are deaf or hard of hearing understand that most parents want unbiased information about communication approaches as well as time and support from professionals and other parents of children who are deaf or hard of hearing in order to determine which communication approach to use with their child.					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
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5.0 Deaf or Hard of Hearing - Early Identification and Early Intervention					
5.1 - Family stress is reduced and child outcomes are improved when early identification occurs and family-focused early intervention is initiated prior to 6 months of age. 5.2 - Parents of children who are deaf or hard of hearing benefit most when the early detection and intervention services and system procedures are shared multiple times and in a variety of formats (e.g., discussion, notebooks, websites). 5.3 - The language development of children who are deaf or hard of hearing should be regularly assessed to ensure that children are meeting language milestones or to consider other interventions or methods of communicating.					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
	There is no evidence that the component is included in the syllabus, or the syllabus only mentions the component.	Must contain at least one of the following: reading, test, lecture/presentation, discussion, modeling/ demonstration, or quiz.	Must contain at least one item from Level 1, plus at least one of the following: observation, project/activity, case study, or lesson plan study.	Must contain at least one item from Level 1 as well as at least one item from Level 2, plus at least one of the following: tutoring, small group student teaching, or whole group internship.	Rate each item as the number of the highest variation receiving an X under it.
6.0 Deaf or Hard of Hearing - Life Skills					
6.1 - Professionals conduct assessments to determine students' present levels of performance as well as to establish if they need a curriculum that includes an emphasis on life skills instruction. 6.2 - Professionals determine whether life skills instruction can be infused into existing courses, specialized courses need to be developed, or courses need to be delivered via community-based instruction. 6.3 - Professionals arrange work-based learning opportunities for students. 6.4 - Professionals work with vocational rehabilitation counselors to provide (a) job placement, (b) AT devices, and (c) job search assistance.					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
	There is no evidence that the component is included in the syllabus, or the syllabus only mentions the component.	Must contain at least one of the following: reading, test, lecture/presentation, discussion, modeling/ demonstration, or quiz.	Must contain at least one item from Level 1, plus at least one of the following: observation, project/activity, case study, or lesson plan study.	Must contain at least one item from Level 1 as well as at least one item from Level 2, plus at least one of the following: tutoring, small group student teaching, or whole group internship.	Rate each item as the number of the highest variation receiving an X under it.
7.0 Deaf or Hard of Hearing - Literacy					
7.1 - Students who are deaf or hard of hearing with functional hearing receive literacy interventions guided by the recommendations of the National Reading Panel (2000) for a balanced reading program (i.e., phonemic awareness, phonics, fluency, vocabulary, and text comprehension). 7.2 - Students who are deaf or hard of hearing with functional hearing receive access to phonological-related information by being taught Visual Phonics, a multisensory system of hand cues and corresponding written symbols that represents the phonemes of English. 7.3 - Students who are deaf or hard of hearing who have limited functional hearing use their knowledge of signs and finger spelling as direct aids to decoding print.					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
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7.0 Deaf or Hard of Hearing - Literacy					
7.4 - Professionals providing early intervention services teach parents/caregivers how to interact and read books with their child who is deaf or hard of hearing. 7.5 - Students who are deaf or hard of hearing (a) are provided with explicit comprehension strategy instruction (e.g., prediction, questioning, imagery, connecting, summarizing); (b) are taught narrative story grammar, (e.g., setting, main characters, problem, attempts to solve the problem, resolution); and (c) use well-written, high-interest texts. 7.6 - Students who are deaf or hard of hearing are taught to read frequently encountered words and are introduced to key words using rich and explicit examples.					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
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7.0 Deaf or Hard of Hearing - Literacy					
7.7 - Students who are deaf or hard of hearing use repeated readings to improve their word recognition, reading rate, and comprehension.					

Essential Components	Implementation Levels				
Instructions: Place an X under the appropriate variation implementation score for each course syllabus that meets the criteria level from 0 to 3. Score and rate each item separately.	**Level 0**	**Level 1**	**Level 2**	**Level 3**	**Rating**
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8.0 Deaf or Hard of Hearing - Mathematics					
8.1 - Professionals working with families and teachers should expose young children who are deaf or hard of hearing to the vocabulary of early mathematical concepts (i.e., numbering, number comparisons, calculation, numeral literacy, and number facts). 8.2 - Students who are deaf or hard of hearing benefit from instruction guided by the Principles and Standards for School Mathematics established by the National Council of Teachers of Mathematics (NCTM) rather than from instruction with an emphasis on memorization, drilling and practice exercises/worksheets, and limited use of technology or investigation of open-ended problems. 8.3 - Students who are deaf or hard of hearing benefit from (a) experience solving and constructing story/word problems of					

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8.0 Deaf or Hard of Hearing - Mathematics					
various kinds that are presented in various forms as the basis for mathematical thinking, communication, and higher order concepts; (b) explicit use and teaching of technical mathematics vocabulary; and (c) integration of mathematics concepts and thinking skills throughout the curriculum to promote problem solving, analysis, and explanation. 8.5 - Students who are deaf or hard of hearing who have an additional disability or are low functioning need functional mathematics instruction (e.g., money value, budgeting, identifying units of liquid and dry measure, height and weight measurement, time management, temperature, graphic representations, time related to scheduled events and calendars).					

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9.0 Deaf or Hard of Hearing - Placement/Inclusion					
9.1 - Effective teaching (e.g., communication, curriculum, instruction, assessment, classroom organization and management) is more important than placement (i.e., where the services are provided) for students who are deaf or hard of hearing. 9.2 - Students who are deaf or hard of hearing receive services from professionals who are able to use different modes of communication as well as adapt instruction and help other professionals adapt instruction for students who are deaf or hard of hearing. 9.3 - Professionals working with students who are deaf or hard of hearing systematically monitor student progress and after collecting, analyzing, and sharing data about student functioning, make adjustments, if needed, in what is taught,					

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9.0 Deaf or Hard of Hearing - Placement/Inclusion					
how it is taught, and, sometimes, where it is taught, based on the current functioning of the student and how that compares to other students. 9.4 - Professionals working with students who are deaf or hard of hearing collaborate and consult with other professionals about strategies for promoting access to instruction and social interactions in all educational environments and to family members in the home and in the community. 9.5 - Professionals working with students who are deaf or hard of hearing help students become involved with extracurricular activities in the school and community. 9.6 - Professionals trained in working with students who are deaf or hard of hearing					

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9.0 Deaf or Hard of Hearing - Placement/Inclusion					
should provide ongoing professional development (PD) and support to other service providers who have not been trained to work with students who are deaf or hard of hearing and who provide services to students who are deaf or hard of hearing.					

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10.0 Deaf or Hard of Hearing - Science					
10.1 - The lags in reading comprehension, vocabulary, and experiential knowledge that often exist for many students who are deaf or hard of hearing negatively limit their knowledge of science concepts. 10.2 - Instructional reliance on textbooks and multimedia (e.g., movies, television shows, lectures) hinders access to science content for students who are deaf or hard of hearing. 10.3 - Students who are deaf or hard of hearing benefit from instruction from professionals who are well prepared in the content area of science and who are able to communicate effectively with them. 10.4 - Students who are deaf or hard of hearing benefit from instruction that includes physical manipulation of objects, use of graphic organizers and highly					

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10.0 Deaf or Hard of Hearing - Science					
pictorial or animated content with simplified English text, and additional practice on vocabulary.					

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11.0 Deaf or Hard of Hearing - Social-Emotional/Behavior					
11.1 - Families are involved in comprehensive early intervention programs to develop healthy attachments and communication skills that facilitate their child's development. 11.2 - Students who are deaf or hard of hearing are taught the language and concepts related to (a) emotional self-awareness, (b) emotional self-regulation, (c) motivation, (d) empathy, and (e) social skills. 11.3 - Adolescents who are deaf or hard of hearing are involved in after-school and/or community-based activities. 11.4 - Professionals who work with students who are deaf or hard of hearing conduct formal and informal assessments of students' social-emotional and behavioral					

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11.0 Deaf or Hard of Hearing - Social-Emotional/Behavior					
functioning in the settings where they spend time.					

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12.0 Deaf or Hard of Hearing - Transition					
12.1 - Professionals working with students who are deaf or hard of hearing provide exposure to information about careers. 12.2 - Professionals working with students who are deaf or hard of hearing facilitate the development of self-determination and self-advocacy skills. 12.3 - Professionals working with students who are deaf or hard of hearing involve students in the development of individual education plan (IE) and transition goals and have students participate in IEP meetings. 12.4 - Professionals working with students who are deaf or hard of hearing use formal and informal assessments to gather information from students, families, and professionals about students' current levels of functioning and future aspirations.					

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12.0 Deaf or Hard of Hearing - Transition					
12.5 - Some students who are deaf or hard of hearing receive independent living and employment skills instruction. 12.6 - Some students who are deaf or hard of hearing benefit from additional English skills instruction so that they are able to succeed in a postsecondary education program.					

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1.0 Visual Impairment - Administration					
1.1 - Personnel certified or licensed in visual impairment are supervised by individuals with knowledge of children and youth with visual impairment. 1.2 - Specialists in visual impairment serve a caseload of eight to 20 students, depending on student needs for instruction in Braille and technology and travel time between students. 1.3 - Educational personnel serving students with visual impairment are certified/licensed in visual impairment and/or orientation and mobility. 1.5 - Students who are visually impaired receive instructional materials at the same time as their peers without disabilities. 1.6 - Paraeducators are assigned to students with visual impairment to supplement and					

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1.0 Visual Impairment - Administration					
not supplant direct instruction from qualified personnel.					

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2.0 Visual Impairment - Asessment					
2.1 - Students with visual impairment are assessed by certified/licensed personnel trained in visual impairment. 2.2 - Assessment of infants and toddlers is conducted in partnership with parents and families and utilizes a family-centered, routines-based approach. 2.3 - Students with visual impairment are routinely evaluated on (a) the need for Braille instruction in reading and writing, (b) the ability to utilize low-vision devices, and (c) the accommodations and modifications necessary to participate and progress in the general education curriculum. 2.4 - Students with visual impairment periodically receive (a) functional vision assessment and (b) learning media assessment.					

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2.0 Visual Impairment - Asessment					
2.5 - Students with visual impairment and additional disabilities are evaluated by certified/licensed personnel trained in visual impairment. 2.6 - Standardized tests are not valid for students with visual impairment, and results should be considered an underestimate of performance.					

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3.0 Visual Impairment - Assistive Technology					
3.1 - Braille instruction in reading and writing includes digital technologies. 3.2 - Image description is an unbiased accommodation for statewide tests. 3.3 - Instructional media include audio descriptions for students with visual impairments. 3.4 - Pre-service teachers of students with visual impairment are trained in specific technologies for students with visual impairments: • Screen-reading software • Screen magnification software • Library Braille translation software • Nemeth Code Braille translation software • Electronic notetakers (Braille and print)					

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3.0 Visual Impairment - Assistive Technology					
• Optical character recognition software • Audio description 3.5 - Certified/licensed personnel in visual impairment periodically renew their skills with in-service training in new technologies. 3.6 - Individualized prescription, training, and use of low-vision devices increases students' visual efficiency and access to print. 3.7 - IEP teams consider whether a specific student with visual impairment requires school-purchased AT in the home. 3.8 - Access technology may be contraindicated for standardized tests.					

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4.0 Visual Impairment - Communication					
4.1 - The following are strategies that assist young children with visual impairments to acquire language skills: • Expansion of verbal language and non-verbal cues • Short and simple sentences to follow directions • Use of songs, nursery rhymes, and chants • Questions that engage or clarify the child's understanding • Use of concrete objects to label and explore • Use of rich descriptions and feedback • Book sharing • Dialogic reading					

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5.0 Visual Impairment - Early Identification and Early Intervention					
5.1 - Early intervention services are mandatory for infants and toddlers with visual impairments. 5.2 - Visual skills may improve with intervention, although a causal effect has not been firmly established. 5.3 - Additional disability has a greater impact on early development than does visual impairment alone. 5.4 - Young children with visual impairments who receive early intervention services may attain developmental milestones at the same rate as children without disabilities. 5.5 - In addition to early intervention services mandated by law, there are early intervention services for infants and toddlers with visual impairments:					

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5.0 Visual Impairment - Early Identification and Early Intervention					
• Certified/licensed personnel trained in visual impairment • Strategies to develop Braille and print awareness • Opportunities to explore writing • Sustained attention to motor development, cognitive development, and parent-child interactions					

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6.0 Visual Impairment - Life Skills					
6.1 - Students with visual impairments receive the following orientation and mobility instruction as a related service: • Sensory awareness • Concept development • Age-appropriate orientation to home and community • Cane travel • Street crossings • Use of public transportation where available • Tactile map reading 6.2 - Students with visual impairments do not learn by visual observation and feedback and require specific instruction in self-care skills, social interaction, recreation and leisure skills, and career education. 6.3 - Students who receive life skills instruction are more socially competent and					

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6.0 Visual Impairment - Life Skills					
may have greater opportunities for employment.					

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7.0 Visual Impairment - Literacy					
7.1 - Literacy instruction follows the recommendations of the National Early Literacy Panel (2008) and the National Reading Panel (2000). 7.2 - Braille literacy is related to adult employment. 7.3 - Disparity in reading rates between children with and without visual impairment becomes greater as children mature. 7.4 - Individualized prescription, training, and use of low-vision devices increase students' access to print (see the Assistive Technology section of this paper). 7.5 - Magnifying devices are more effective than hard-copy enlarged print. 7.6 - Students with visual impairments require regular and sustained interventions					

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7.0 Visual Impairment - Literacy					
by trained and certified/licensed personnel, regardless of whether they are print or Braille readers. 7.7 - Successful literacy strategies for children with visual impairment include the following: • Repeated readings • Direct instruction in phonemes • Decoding morphemes • Vocabulary instruction for older students • Many literacy experiences • Many reading genres • Family-centered approaches • Language supports • Concept development • Sufficient background information and vocabulary to foster comprehension • Instruction with peers					

Essential Components	Implementation Levels				
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7.0 Visual Impairment - Literacy					
• Instruction from certified/licensed personnel trained in visual impairment • Immersing students in Braille • Modeling literacy behaviors • Focusing on meaning • Integrating listening, speaking, reading, and writing • Drill and practice with the Braille code • Encouraging students to participate in decision making 7.8 - Younger children are exposed to both print and bBaille until they indicate a preference or efficiency for one modality over the other. 7.9 - Students' literacy achievement is monitored continuously.					

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7.0 Visual Impairment - Literacy					
7.10 - Consistent reading instruction within a structured format, including drill and practice, leads to increased reading achievement by students who read Braille. 7.11 - Listening is an efficient reading medium for some students reading some genres, particularly when the speed can be controlled by the individual. 7.12 - The age of introduction to Braille is related to later Braille reading speed. 7.13 - Spelling accuracy is associated with early introduction of braille contractions. 7.14 - Introduction of Braille contractions as these naturally occur in reading material is associated with higher literacy performance as children mature.					

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7.0 Visual Impairment - Literacy					
7.15 - A two-handed approach to reading Braille is associated with greater reading speed and accuracy. 7.16 - Braille instruction is provided to students with visual impairment regardless of the following issues: • Shortages of trained and certified/licensed personnel • Availability of alternative reading media • Amount of time required to provide sufficient instruction					

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8.0 Visual Impairment - Mathematics					
8.1 - Instruction in mathematics includes concrete aids and devices. 8.2 - Instruction using the abacus has limited empirical support for its effectiveness.					

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9.0 Visual Impairment - Placement/Inclusion					
9.1 - A range of placement options is available to students with visual impairments; placement is determined by individual student needs and the individualized educational program.					

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10.0 Visual Impairment - Science					
10.1 - Intervention strategies for teaching science follow the general principles for accommodations and modifications pertinent to students with visual impairments.					

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11.0 Visual Impairment - Social-Emotional/Behavior					
11.1 - The following interventions reduce self-injurious and repetitive behaviors and promote entry into social groups: • Self-evaluation and feedback • Positive reinforcement • Punishment • Prompting • Increased physical activity 11.2 - Students with visual impairments require a repertoire of specifically taught social skills to gain entry into social groups.					

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12.0 Visual Impairment -Transition					
12.1 - Future employment is associated with the following experiences during secondary school: • Early work experiences • Computer experiences • Social skills, including independent living skills and self-determination • Orientation and mobility skills					

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1.0 Deafblindness - Administration					
1.1 - Each educational team includes one member who is knowledgeable about effective assessment and instructional approaches for students who are deafblind. 1.2 - Small instructional groups are provided to ensure access, engagement, and sufficient instructional feedback.					

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2.0 Deafblindness - Assessment					
2.1 - Informal assessment instruments and procedures are essential to capturing the students' abilities and needs. The sole use of formal instruments is inappropriate. 2.2 - Assessments are conducted across multiple and natural environments with input from multiple adults. 2.3 - The strengths and needs of the family are identified as part of early childhood assessment. 2.4 - Functional vision assessment, functional hearing assessment, and learning media assessment are conducted for each student. 2.5 - Use person-centered assessment approaches to identify meaningful outcomes and necessary educational supports.					

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2.0 Deafblindness - Assessment					
2.6 - Professionals are very cautious while identifying additional disabilities in students who are deafblind. The diagnostic criteria used with other students may not be applicable. 2.7 - Assessments are conducted for the visual, auditory, and tactile characteristics of each environment in which students engage or may engage in to (a) determine potential impact on student, (b) support communication planning, and (c) plan appropriate adaptations and accommodations.					

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3.0 Deafblindness - Assistive Technology					
3.1 - Select AT based on assessment of each student. 3.2 - Students who are deafblind experience unique benefits, risks, and potential outcome predictors from cochlear implants. The team member with deafblind expertise should know this research. 3.3 - When reporting benefits or lack of benefits, consider non-speech outcomes, including improved awareness of environmental sounds or increased responsiveness.					

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4.0 Deafblindness - Communication					
4.1 - Communicative development and social interactions are emphasized every day in the context of natural environments. 4.2 - Communication programming addresses forms/modes, intents/functions, content, context, and pragmatics. 4.3 - Child-guided approaches are applied to support communication development and different types of dialogues. 4.4 - Systematic instructional approaches are used to increase the rate and variety of communicative intents/functions expressed. 4.5 - Individualized communication programming that reflects knowledge of the students' levels of communication is implemented.					

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4.0 Deafblindness - Communication					
4.6 - Adult communication partner skills are improved through systematic demonstration and modeling. 4.7 - Tangible representations/symbols are a critical form of communication for prelinguistic students who are deafblind. 4.8 - Tactile approaches and strategies to improve communication in students who are deafblind are implemented.					

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5.0 Deafblindness - Early Identification and Early Intervention					
5.1 - Early identification and early intervention are provided to reduce the developmental disadvantages posed by deafblindness. 5.2 - Students who are deafblind require highly specialized and individualized services provided by collaborative teams that respect the role of the family in optimizing outcomes. 5.3 - Young students will benefit from caregiver preparation to (a) recognize the child's cues for interaction, (b) establish routines to elicit anticipation, and (c) provide contingent responses.					

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6.0 Deafblindness - Life Skills					
6.1 - Daily living skills are improved through systematic instruction that includes task analysis and the application of behavioral principles such as graduated guidance. 6.2 - With the guidance of the Certified Orientation and Mobility Specialist (COMS), professionals help students improve orientation and mobility skills through systematic instruction in the context of structured activities that are desirable and functional. 6.3 - Orientation and mobility instruction for students who are deafblind must be modified from what is offered to students who are visually impaired by considering (a) the impact of deafblindness, (b) potential balance issues, (c) unique communication needs, and (d) length or number of sessions					

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6.0 Deafblindness - Life Skills					
(due to sequential communication while traveling).					

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7.0 Deafblindness - Literacy					
7.1 - An expanded view of literacy that goes beyond traditional reading and writing is required to address the needs of students who are deafblind and prelinguistic. 7.2 - Provide a literacy-rich environment with hands-on experiences to conceptually ground the literacy experiences.					

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8.0 Deafblindness - Mathematics					
8.1 - Professionals use consistent wording for mathematical symbols and operations. 8.2 - While preparing to teach each math lesson, professionals consider (a) students' experiential knowledge, (b) vocabulary demands of lessons, (c) need to modify content, (d) need for manipulates to support understanding, and (e) need for adaptations to improve access and participation. 8.3 - Professionals provide instruction on the use of specialized mathematics equipment and specialized approaches such as the abacus or mental math.					

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9.0 Deafblindness - Placement/Inclusion					
9.1 - Collaborative teaming is essential to the successful inclusion of students who are deafblind. 9.2 - Paraprofessionals with specialized preparation or interveners are crucial to the success of children who are deafblind. 9.3 - Adults must create opportunities for reciprocal interactions between students who are deafblind and their peers and offer direct instruction about how to interact. 9.4 - The principles of Universal Design for Learning (UDL) are applied to enhance access, participation, and engagement. 9.5 - The three UDL principles are (a) multiple means of representation, (b) multiple means of action and expression, and (c) multiple means of engagement.					

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10.0 Deafblindness - Science					
10.1 - While preparing to teach each lesson, professionals consider (a) students' experiential knowledge, (b) vocabulary demands of the lesson, (c) the need for modification of content, (d) adaptations and accommodations, and (e) non-visual means of presentation. 10.2 - Professionals provide inquiry-based science lessons to promote active engagement.					

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11.0 Deafblindness - Social-Emotional/Behavior					
11.1 - Professionals identify the purpose fulfilled by unacceptable behaviors. 11.2 - Professionals teach socially acceptable ways of communicating and replacement behaviors for unacceptable behaviors. 11.3 - Knowledge of the child's etiology and the impact of deafblindness are critical to assessment and planning individualized positive behavior support plans. 11.4 - Professionals apply behavioral principles to reduce or eliminate stereotypes, self-injurious behaviors, and aggression toward others. 11.5 - Appropriate changes in curriculum, environment, and the nature of adult responses can support positive change in behavior in children who are deafblind.					

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12.0 Deafblindness - Transition					
12.1 - Vocational experiences during secondary education increase the likelihood of post-school employment. 12.2 - An interagency approach to Personal Futures Planning is critical to (a) capturing the strengths and needs of the individual and (b) planning natural and paid supports for all aspects of adult living.					