Septo-Optic Dysplasia (SOD): Educational Issues in Literature for Teachers and Parents

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Abstract

Ninety-nine articles published in professional journals related to septo-optic dysplasia (SOD) or the education of young blind children were reviewed by a special education teacher and parent of a blind one year old boy diagnosed with the SOD. The articles were classified by publication type (e.g., research studies, descriptive articles, guides, position papers, reviews of literature). Fifty-three of the 99 articles were research studies; these 53 research studies were classified by research design (i.e., quantitative, qualitative, or mixed methods); the participants and data sources of each study were identified; and the findings of each study were summarized. All 99 articles were then analyzed using a modified version of the Stevick-Callaizi-Keen method to draw out the essential themes of this body of literature. The 11 themes that emerged from this analysis included: (a) septo-optic dysplasia and optic nerve hypoplasia; (b) parenting and early intervention; (c) cognitive development; (d) language development; (e) orientation and mobility; (f) social behavior; (g) assistive technology; (h) educational placement; (i) emergent literacy; (j) Braille literacy; and (k) assessment. These themes were then considered from the author's roles of parent and teacher.

1. Introduction

1.1. Background

Septo-optic dysplasia (SOD) is a term coined by de Morsier in 1956 to describe a condition that includes both optic nerve hypoplasia (ONH) and the agenesis of the septum pellucidum. The syndrome was first described by Reeves 15 years earlier. These two features of SOD may be related more simply as a midline brain malformation and an underdeveloped optic nerve. Both features have varying degrees of severity ranging from correctable vision to total blindness, and from normal intelligence to cognitive impairment, or mental retardation. Additionally, another 15 years after de Morsier's foundational work, Kaplan et al. showed the syndrome to be highly associated with pituitary hormone insufficiencies (Hellström et al., 2000). Such issues with the pituitary region of the brain, or hypopituitarism, may impact growth rate and the natural defenses of the body among other things.

ONH, whether or not it yields a diagnosis of SOD, is quickly growing as an educational issue, whereas before it was seen as merely a medical concern. ONH is recognized for being an epidemic cause of congenital blindness in children over the past 30 years. Evidence shows, however, that ONH rarely occurs in isolation (Borchert & Garcia-Filion, 2008).

A child with ONH often has additional issues beyond vision impairment in the areas of midline deficiencies and pituitary hormone production affecting such things as growth rate, muscle tone, energy, and regulation of various processes in the body that may result in hypoglycemia, seizures, motor deficits, or behavior problems. These may or may not be identified in the first year with lab results and magnetic resonance imaging (MRI), and thus, may not have a diagnosis of SOD. Yet evidence of both midline brain anomalies and pituitary imbalances may surface later in time. Some pediatricians are urging regular lab work to monitor

changes in pituitary function for children with ONH. Yet, this regular monitoring may not occur and the issues mentioned above may have profound educational impact before a diagnosis of midline deficiencies or hypopituitarism is made (Tait, 1989).

This condition, here referred to as SOD, may impact a child's rights under the Individuals with Disabilities Education and Improvement Act (IDEA) of 2004. A child with SOD may qualify for special education services under any number of categories, including visual impairment, cognitive impairment (which IDEA calls "mental retardation"), or multiple disabilities. According to IDEA, *visual impairment*, including blindness, means an impairment in vision that, even with correction, adversely affects a child's educational performance. The term includes both partial sight and blindness (Sec. 300.8(c)(13)). *Mental retardation* means significantly sub-average general intellectual functioning, existing concurrently with deficits in adaptive behavior and manifested during the developmental period that adversely affects a child's educational performance (Sec. 300.8(c)(6)). Multiple disabilities means concomitant impairments (such as mental retardation-blindness or mental retardation-orthopedic impairment), the combination of which causes such severe educational needs that they cannot be accommodated in special education programs solely for one of the impairments. The category multiple disabilities does not include deaf-blindness, which exists as a separate category under IDEA (Sec. 300.8(c)(7)).

1.2. Author's beliefs and experiences

As marked by years, my experience as a parent is half that of a teacher. Yet my convictions toward this first vocation have been in formation far longer, and indeed, run much deeper than those as a teacher. It is my belief that I hold both more potential in my work as a parent and more responsibility in this role. At the same time, this belief is evident in my philosophy of education,

and hopefully in my practices as a teacher or administrator. Hence, I have extended this topic to the educational issues of students with SOD for both teachers and parents.

Married eight years now, my wife and I have five children – seven, six, five, three, and one years old. The second and fifth children are adopted. Very recently, we have been given an opportunity to adopt a nine-month-old boy with SOD and ONH. While this process of adoption may be slow to unfold, I do not wish for my imagination to be as slow to spread out early interventions on behalf of this child. His brain and sensory development at this young age will have tremendous impact upon his future education and ability to function independently.

My experience teaching in special education began in 1996 in rural Alaska. During the last 13 years, I have had the opportunity to work with special education students with several different disabilities. Most often, as a resource teacher, I have only needed to study what was currently known of prominent health impairments, such as attention deficit hyperactivity disorder (ADHD), fetal alcohol spectrum disorder (FASD), and autism spectrum disorder (ASD). However, other specific conditions may also have a severe educational impact. In our district's "continuum of services" model, special education teachers are not necessarily specialized in any one or two disabilities, as once we might have been more popularly called "LD teachers" (i.e., an outdated term in my school district for special education teachers who teach students with high prevalence disabilities). Instead, we have preschool teachers, resource teachers, extended resource teachers, and intensive resource teachers. Their title is indicative of a placement for special education services. Naturally, the needs of various students within a single disability category will vary widely and should be met in their own appropriate least restrictive environment (LRE). For this reason also, I place my interest in this very specialized condition. The special education teacher should continue to expand his or her professional breadth under

this model of services. Teacher and parent alike will do well to share meaningful research in the area of a student's disability.

1.3. Purpose of this meta-synthesis

This meta-synthesis attends to the overall subject of SOD as it relates to the development of a young child. One purpose of this review then was to identify journal articles that address the education of children having severe visual impairments or blindness. A second purpose was to identify journal articles related specifically to SOD in the educational literature. A third purpose was to classify these articles by publication type, research design, and emergent themes. My final purpose was to prepare myself to be an effective parent of a child with SOD.

2. Methods

2.1. Selection criteria

The journals included in this meta-synthesis met the following selection criteria:

1. The articles related to SOD in medical and/or educational contexts.
2. The articles related to blindness in young children (i.e., birth to eight years old).
3. The articles related to educating and/or parenting children with SOD or blindness.
4. The articles were published in professional journals.
5. The articles were authored by medical professionals or educators.
6. The articles were published after 1978.

2.2. Search procedures

I searched four databases that index literature related to SOD and/or educating young children with blindness. These four databases included: (a) ERIC (Ebscohost); (b) Professional

Development Collection (Ebscohost); (c) Education Journals (ProQuest); and (d) Education Abstracts (OCLC FirstSearch). I also conducted ancestral searches.

2.2.1. ERIC (Ebscohost)

A Boolean search using the subject descriptors ("early childhood education" OR "young children") AND ("education" AND "blindness") NOT ("deaf blind") limited to the publication type "journal articles" returned 31 results. 29 of these results met my selection criteria and were included in this review of the literature (Bahar, Brody, McCann, Mendiola, & Slott, 2003; Campbell, 2003; Celeste, 2005; Drezek, 1999; Eichel, 1979; Emerson, Holbrook, & D'Andrea, 2009; Erwin, 1991; Ferguson & Buultjens, 1995; Ferrell, 1984; Fletcher, 1981; Foy, Scheden & Waiculonis, 1992; Goergen, 1997; Hill, 1992; Kondellas, 2004; Landau, Gleitman, & Spelke, 1981; McComiskey, 1996; Moore, 1982; Pring, 1994; Raver, 1987; Sampaio, 1989; Segond, Weiss, & Sampaio, 2007; Simmons & Davidson, 1992; Skellenger & Hill, 1994; Stauffer, 2008; Stratton, 1996; Stratton & Wright, 1991; Swenson, 1987; Troster, Hecker, & Brambring, 1994; Wheeler & And, 1997).

2.2.2. Professional Development Collection (Ebscohost).

A Boolean search with subject descriptors ("septo-optic dysplasia" OR "Optic nerve hypoplasia") OR ("education" AND "blindness" AND "children") NOT ("autism" OR "deaf blind") limited to scholarly peer reviewed journals returned eight articles. Four of these met my selection criteria and were included in this review of the literature (Ajuwon & Oyinlade, 2008; Bowen & Ferrell, 2003; French, 2006; Muhlenhaupt, 2002).

2.2.3. Education Journals (ProQuest).

A Boolean search for the terms ("septo-optic dysplasia" OR "optic nerve hypoplasia") AND ("education") AND NOT ("autism" OR "deaf-blind"), selecting "citation and document text"

and limiting the search to scholarly journals returned 10 results. Seven of these articles were relevant to my selection critieria (Bahar, Brody, McCann, Mendiola, & Slott, 2003; Bak, 1999; Budd & LaGrow, 2000; Emerson, Sitar, Erin, Wormsley, & Herlich, 2009; Erickson, Hatton, Roy, Fox, & Renne, 2007; Kesiktas, 2009; Lusk & Corn, 2006). One article was found in a previous search and is already included in this review of literature (Bahar, Brody, McCann, Mendiola, & Slott, 2003).

A second Boolean search was conducted using the terms ("early childhood education" OR "young children") AND ("education" AND "blindness") NOT ("deaf-blind"), and also limited to scholarly journals. I selected "citation and abstract" for each of these terms. The search returned 11 articles, five of which met my selection criteria (Dote-Kwan, Chen, & Hughes, 2009; Holbrook, 2008; Murphy, Hatton, & Erickson, 2008; O'Connell, Lieberman, & Petersen, 2006; Richert, 2007).

2.2.4. Education Abstracts (OCLC First Search)

A Boolean search with keyword terms ("septo-optic dysplasia" OR "optic nerve hypoplasia") OR ("education" AND "blindness" AND "young children") NOT ("autism" or "deaf-blind") limited to document type "articles" returned 18 results. Seventeen of these results met my selection criteria and were included in this review of the literature (Bahar, Brody, & McCann, 2003; Beelmann & Brambring, 1998; Cowan & Shepler, 1990; Dennison, 2000; Erickson & Hatton, 2007; Erwin, 1991; Erwin, 1993; Hatton, 2001; Holbrook, Wadsworth, & Bartlett, 2003; Koenig & Farrenkopf, 1997; Liedtke, 1998; May, Johnson, & Schwarz, 2003; Murphy, Hatton, & Erickson, 2008; Recchia, 1997; Richert, 2007; Skellenger & Hill, 1994; Tait, 1989). Five of these articles were already located in previous searches (Bahar, Brody, & McCann, 2003; Erwin, 1991; Murphy, Hatton, & Erickson, 2008; Richert, 2007; Skellenger &

Hill, 1994).

2.2.5. Ancestral searches

An ancestral search involves the examination of references listed in articles previously located to find additional articles relevant to one's topic. In my own ancestral searching, I reviewed the reference lists of the articles retrieved from the four database searches and located 43 new articles that met my search criteria (Andersen, Dunlea, & Kekelis, 1984; Andersen, Dunlea, & Kekelis, 1993; Celeste, 2007; Davidson & Simmons, 1984; Dodd & Conn, 2000; Dote-Kwan & Hughes, 1994; Edmonds & Pring, 2006; Fletcher, 1980; Hamp & Caton, 1984; Harley & Engish, 1989; Hatlen, 2004; Hughes, Dote-Kwan, & Dolendo, 1999; Kekelis & Andersen, 1984; Koenig & Holbrook, 2000; McConachie & Moore, 1994; Miletic, Hughes, & Bach-y-Rita, 1988; Miller, 1985; Minter, Hobson, & Pring, 1991; Moore & McConachie, 1994; Ochaita & Huertas, 1993; O'Donnell & Livingston, 1991; Pereira, 1990; Pérez-Pereira & Castro, 1997; Pérez-Pereira & Conti-Ramsden, 2001; Potter, 1995; Preisler, 1993; Pring, 1984; Pring 1985; Rettig, 1994; Rex, 1989; Rogow, 1983; Ross & Tobin, 1997; Schuyler, 2005; Sleeuwenhoek & Boter, 1995; Steinman, LeJeune, & Kimbrough, 2006; Stuart, 1995; Swenson, 1991; Tait & Wolfgang, 1984; Troster, 2001; Ungar & Blades, 1997; Wittenstein, 1993; Wittenstein & Pardee, 1996; Zeppuhar & Walls, 1998).

2.3. Coding procedures

For categorizing the information in each of these 99 articles, I developed a coding form based upon: (a) publication type; (b) research design; (c) participants; (d) data sources; and (e) findings.

2.3.1. Publication type

While reviewing the literature returned from my searches, I evaluated and classified each

article according to publication type (e.g., empirical study, descriptive article, position paper, guide, annotated bibliography). Empirical studies are those studies that have a clearly articulated method for obtaining and analyzing data, both quantitative and/or qualitative. Descriptive articles, on the other hand, describe an experience or event but do not have a method for gathering and analyzing data. Position papers explain, justify or recommend some opinion or action. Guides are articles that recommend a program or strategy and describe how the reader may use it in particular contexts. Annotated bibliographies include a list of relevant sources on a topic with short descriptions of each publication (Duke & McCarthy, 2009; Duke & Ward, 2009).

2.3.2. Research design

I evaluated and classified each study by research design (i.e., quantitative research, qualitative research, mixed methods research). Quantitative research is a process of gathering and analyzing numerical data. It is a systematic investigation that uses a controlled method for observing phenomena, collecting data, analysis, interpretation, and generalization. Quantitative research design may include: experimental, quasi-experimental, correlational, or descriptive approaches for measuring and comparing relationships. Qualitative research is a process of creating and analyzing data that is expressed in words. Phenomena is not controlled like it is in quantitative research, but conditions that already exist are observed, analyzed and described. Mixed methods research utilizes elements of both quantitative and qualitative research (Welch, Brownell, & Sheridan, 1999).

2.3.3. Participants, data sources, and findings

I identified the participants in each of the empirical studies (e.g., children with blindness, parents of children with visual impairment). I also identified the data sources in each study (e.g.,

interviews, surveys, observation, test scores). Finally, I summarized the findings of each study.

2.4. Data analysis

I used a modified version of the Stevick-Colaizzi-Keen method of data analysis previously employed by Duke and Ward (2009) and Duke and McCarthy (2009) to analyze the 99 articles I reviewed for the meta-synthesis. First, "significant statements" were identified within each article. For this study, I defined significant statements as any statement pertaining to the education or parenting of a child with severe visual impairment, or a statement relating to SOD. Next, I assembled a list of non-repetitive, non-overlapping "significant statements." I paraphrased these into "formulated meanings" to represent my analysis of each "significant statement." Finally, I grouped the "formulated meanings" from all 99 articles into "theme clusters" (or "emergent themes").

3. Results

3.1. Publication types

Fifty-three of the 99 articles (53.5%) included in this review of the literature were empirical studies. Twenty-five of the articles (25.3%) were descriptive articles. Fourteen of the articles (14.1%) were guides. Six of the articles (6.1%) were position papers. One of the articles (1%) was a review of the literature. None of the articles meeting my selection criteria were annotated bibliographies. All of these articles are listed in Table 1 with their publication type.

Table 1

Author(s) & Year of Publication	Publication Type
Ajuwon & Oyinlade, 2008	Empirical Study
Andersen, Dunlea, & Kekelis, 1984	Empirical Study
Andersen, Dunlea, & Kekelis, 1993	Position Paper
Bahar, Brody, McCann, Mendiola, & Slott, 2003	Guide
Bak, 1999	Empirical Study
Beelmann & Brambring, 1998	Empirical Study
Bowen & Ferrell, 2003	Descriptive Article
Budd & LaGrow, 2000	Empirical Study
Campbell, 2003	Empirical Study
Celeste, 2005	Empirical Study
Celeste, 2007	Empirical Study
Cowan & Shepler, 1990	Guide
Davidson & Simmons, 1984	Descriptive Article
Dennison, 2000	Descriptive Article
Dodd & Conn, 2000	Empirical Study
Dote-Kwan & Hughes, 1994	Empirical Study
Dote-Kwan, Chen, & Hughes, 2009	Empirical Study
Drezek, 1999	Guide
Edmonds & Pring, 2006	Empirical Study
Eichel, 1979	Descriptive Article
Emerson, Holbrook, & D'Andrea, 2009	Empirical Study
Emerson, Sitar, Erin, Wormsley, & Herlich, 2009	Empirical Study
Erickson & Hatton, 2007	Empirical Study

Erickson, Hatton, Roy, Fox, & Renne, 2007	Empirical Study
Erwin, 1991	Guide
Erwin, 1993	Empirical Study
Ferguson & Buultjens, 1995	Empirical Study
Ferrell, 1984	Empirical Study
Fletcher, 1980	Empirical Study
Fletcher, 1981	Empirical Study
Foy, Scheden, & Waiculonis, 1992	Guide
French, 2006	Position Paper
Goergen, 1997	Guide
Hamp & Caton, 1984	Descriptive Article
Harley & English, 1989	Empirical Study
Hatlen, 2004	Descriptive Article
Hatton, 2001	Empirical Study
Hill, 1992	Empirical Study
Holbrook, 2008	Position Paper
Holbrook, Wadsworth, & Bartlett, 2003	Empirical Study
Hughes, Dote-Kwan, & Dolendo, 1999	Empirical Study
Kekelis & Andersen, 1984	Empirical Study
Kesiktas, 2009	Descriptive Article
Koenig & Farrenkopf, 1997	Empirical Study
Koenig & Holbrook, 2000	Empirical Study
Kondellas, 2004	Descriptive Article
Landau, Gleitman, & Spelke, 1981	Empirical Study
Liedtke, 1998	Guide

Lusk & Corn, 2006	Empirical Study
May, Johnson, & Schwarz, 2003	Descriptive Article
McComiskey, 1996	Guide
McConachie & Moore, 1994	Empirical Study
Miletic, Hughes, & Bach-y-Rita, 1988	Descriptive Article
Miller, 1985	Descriptive Article
Minter, Hobson, & Pring, 1991	Empirical Study
Moore, 1982	Guide
Moore & McConachie, 1994	Empirical Study
Muhlenhaupt, 2002	Guide
Murphy, Hatton, & Erickson, 2008	Empirical Study
Ochaita & Huertas, 1993	Empirical Study
O'Connell, Lieberman, & Petersen, 2006	Guide
O'Donnell & Livingston, 1991	Descriptive Article
Pereira, 1990	Descriptive Article
Pérez-Pereira & Castro, 1997	Empirical Study
Perez-Pereira & Conti-Ramsden, 2001	Empirical Study
Potter, 1995	Descriptive Article
Preisler, 1993	Empirical Study
Pring, 1984	Empirical Study
Pring, 1985	Empirical Study
Pring, 1994	Descriptive Article
Raver, 1987	Empirical Study
Recchia, 1997	Position Paper
Rettig, 1994	Guide

Rex, 1989	Descriptive Article
Richert, 2007	Position Paper
Rogow, 1983	Descriptive Article
Ross & Tobin, 1997	Descriptive Article
Sampaio, 1989	Empirical Study
Schuyler, 2005	Descriptive Study
Segond, Weiss, & Sampaio, 2007	Empirical Study
Simmons & Davidson, 1992	Position Paper
Skellenger & Hill, 1994	Empirical Study
Sleeuwenhoek & Boter, 1995	Descriptive Article
Stauffer, 2008	Empirical Study
Steinman, LeJeune, & Kimbrough, 2006	Descriptive Article
Stratton, 1996	Guide
Stratton & Wright, 1991	Descriptive Article
Stuart, 1995	Empirical Study
Swenson, 1987	Guide
Swenson, 1991	Descriptive Article
Tait, 1989	Review of the Literature
Tait & Wolfgang, 1984	Empirical Study
Troster, 2001	Empirical Study
Troster, Hecker, & Brambring, 1994	Empirical Study
Ungar & Blades, 1997	Empirical Study
Wheeler & And, 1997	Descriptive Article
Wittenstein, 1993	Empirical Study
Wittenstein & Pardee, 1996	Descriptive Article

Zeppuhar & Walls, 1998	Empirical Study

3.2. Research design, participants, data sources, and findings of the studies

There were 53 empirical studies in my review of the literature that met my selection criteria. I have provided the research design, participants, data sources, and findings of these studies in Table 2.

Table 2

Authors	Research Design	Participants	Data Sources	Findings
Ajuwon & Oyinlade, 2008	Quantitative	222 parents of blind or severely visually impaired children across the country	Questionnaire	Children are more likely to be placed in residential schools on the basis of education and well-being, and placed in public schools on the basis of parents' needs.
Andersen, Dunlea, & Kekelis, 1984	Quantitative	6 children under 4-years-old ranging from congenital blindness to full sight	Observation	There are differences in early language development between blind and sighted children, given the lack of visual information to give perspective and context to word meaning, and indicating differences in cognitive development.
Bak, 1999	Quantitative	202 children with visual impairments; 60% had additional disabilities	Test scores	Severity of inappropriate and unusual behavior among children with visual impairments correlates with intellectual function and communication abilities.
Beelmann & Brambring, 1998	Quantitative	10 blind children, with a mean age of 12 months	Test scores and observation of interventions	Individualized, handicap-specific early intervention that used different types of parental involvement to facilitate development in young children with visual impairments were successful for full-term children, but showed no effect for preterm children.
Budd & LaGrow, 2000	Quantitative	4 visually impaired children 7 to 11-years-old	Pre-test and post-test measures	Using an interactive model was effective in teaching environmental concepts to children with visual impairments.
Campbell, 2003	Quantitative	4 blind and 4 sighted children at 18 months, and their mothers	Observation	Mothers of blind children were no more directive in statements made than mothers of sighted children, though their use of some

				directives were specific to the needs of their children.
Celeste, 2005	Quantitative	Twin boys, one blind, one sighted	Test scores	The developmental outcomes of the twins varied as a result of differences in vision loss and the medical risk factors inherent with twin-to-twin transfusion syndrome, though the degree by which either factor was cause is not possible to determine.
Celeste, 2007	Quantitative	Blind preschool child	Pre-test and post-test measures, and pre-/post-observation of play behavior	After a social skills intervention, a blind preschool child showed an increased amount and scope of play behaviors and social interactions.
Dodd & Conn, 2000	Quantitative	15 blind children 7-12 years-old	Test scores	Blind children performed poorer in phonological awareness skills than sighted children the same age. Also, blind children segmented heard words that can appear in contracted braille less well than words that are never contracted.
Dote-Kwan & Hughes, 1994	Quantitative	18 mothers and their blind children, aged 20-36 months, with no other disabilities	Test scores	Overall home environment was not related to any developmental scores in the children with VISUAL IMPAIRMENTS, yet the emotional and verbal responsivity of seven mothers correlated with the expressive pragmatic language of their children. SES was not related to the quality of the home environment, nor the children's development.
Dote-Kwan, Chen, & Hughes, 2009	Quantitative	19 Latino and Anglo toddlers with visual impairments & their parents	Survey and observation	Latino and Anglo toddler development was not significantly different. While socioeconomic status differed between both

				groups, the home environments did not. Differences existed between the mothers' perceived needs on the basis of ethnicity and degree of vision loss.
Edmonds & Pring, 2006	Quantitative	17 sighted children and 17 children with visual impairments, 7-11 years-old	Test scores	Children with visual impairments are comparable with sighted children in the ability to make inferences. Children with visual impairments show an advantage for answering literal questions from material presented in auditory form.
Emerson, Holbrook, & D'Andrea, 2009	Quantitative	42 beginning braille students, visually impaired with no additional disabilities, having had no literacy instruction	Test scores	Students introduced to the 189 contractions earlier in braille instruction did better in vocabulary and spelling, while students exposed to fewer contractions showed less acquisition of high-level decoding skills. Visually impaired braille readers acquire reading skills at a slower rate compared with their sighted peers.
Emerson, Sitar, Erin, Wormsley, & Herlich, 2009	Mixed Methods	38 young blind children with no additional disability	Test scores, interviews, and observations	The findings did not distinguish high and low achievers of literacy skills on the basis of age, visual impairment etiology, family attitude or behaviors toward literacy, class size, or time with a teacher of the visually impaired. Differences between these groups were found in measures of social interactions, introduction to contractions, time spent with para-educators, and the provision of consistent

				structured reading instruction.
Erickson & Hatton, 2007	Qualitative	three preschool teachers of children with visual impairments	Field notes, interviews, and document reviews	Three components of emergent literacy are suggested and examined as a framework for understanding literacy acquisition in children with VI: (a) oral language, (b) metalinguistic skills, and (c) print / braille knowledge.
Erickson, Hatton, Roy, Fox, & Renne, 2007	Qualitative	Two early interventionists of infants & toddlers with visual impairments or blindness	Field notes, interviews, and document reviews	The role of early interventionists in supporting emergent literacy in young children with visual impairments is explored, addressing in particular: (a) a family-centered approach, (b) language and concept development, and (c) a focus on the senses as they relate to literacy and other functional outcomes.
Erwin, 1993	Quantitative	28 young children with visual impairments	Observation	There was no significant difference in the social participation of children with visual impairments across specialized and integrated settings. In both settings, the greatest proportion of time was spent in solitary play, and the least was spent transitioning from one activity to another.
Ferguson & Buultjens, 1995	Quantitative	16 young blind children	Observation and test scores	Children with high scores on developmental scales also were observed to have high levels of 'fantasy' play. 'Pretend' play in blind children enlisted symbolic use of language and imitation but not symbolic use of objects, indicating play may merely be

				different in blind children, not delayed. Children with low scores in language and sensory motor spent more time in exploratory play.
Ferrell, 1984	Quantitative	18 visually impaired infants between 6 and 24 months	Observation, pre-test and post-test measures	Results indicate that environmental sensory aids have had no clear impact on the process of sensory integration, and should not be used in early childhood until further research of perceptual, cognitive, and motor development is done.
Fletcher, 1980	Quantitative	68 children 7-18 years-old; 34 blind with no other disability and 34 sighted but blindfolded	Test scores, or performance on 16 map questions about the furniture of an explored room	Results from this study disprove the deficiency theory that would state congenitally blind persons are incapable of synthesizing tactile information into a complete mental image, or cognitive map. Nor do the results provide conclusive support of the inefficiency or difference theories.
Fletcher, 1981	Quantitative	34 blind children with no other disabilities ages 7-18 years old	Medical records, teacher surveys, and test scores from above experiment	General intellectual ability, cause of blindness, and visual acuity prior to age 3 are factors that had a significant impact on blind children's ability to answer cognitive mapping questions, and little effect on route questions.
Harley & English, 1989	Quantitative	41 state and private residential schools	Survey	All the residential schools in this sample were providing services to children with visual impairments in local schools. The most prominent services included: (a) professional development, (b) preschool, summer school, and special intervention programs, and

				(c) books, supplies and equipment.
Hatton, 2001	Quantitative	406 children from birth to age 3 with visual impairments	Survey	Characteristics of young children with visual impairments were described in this sample in an effort to facilitate planning visual impairment services and personnel. The majority were legally blind and had additional disabilities, and the three most prevalent conditions were cortical visual impairment, retinopathy of prematurity, and optic nerve hypoplasia.
Hill, 1992	Mixed Methods	20 Orientation & Mobility (O&M) instructors field testing a screening tool on 24 preschoolers with visual impairments	Likert-type rating scales and narrative comments	Experts found this O&M screening to have the needed content important when screening a diverse population of preschoolers with visual impairments, as well as specific and appropriate directions for administering the screening.
Holbrook, Wadsworth, & Bartlett, 2003	Qualitative	15 teachers of students with visual impairments and their beginning braille students	Questionnaires and unstructured interviews	After evaluating the use of the Mountbatten Brailler with young braille-reading children, teachers believed it to be a beneficial tool for early literacy learning, well perceived by sighted peers and with friendly design for both braille and print use.
Hughes, Dote-Kwan, & Dolendo, 1999	Quantitative	17 mothers each with their visually impaired child, ages 20-36 months	Observation, rating scale for measuring caregiver behavior, and test scores	A blind or visually impaired child's language, sensorimotor, and exploration skills development are enhanced by the following maternal behaviors: (a) quality of responsiveness, (b) appropriateness of directive behavior, and (c) the quality of both control and goal

				setting. Pragmatic language development is hurt by large amounts of maternal control and directiveness.
Kekelis & Andersen, 1984	Mixed Methods	Four blind and two sighted children and their families with no other disabilities	Observation, transcription, and interviews	In response to the special needs of blind children and the absence of visual cues, caregivers of the blind tend to provide more directive input with minimal descriptions; they initiate more of the conversations, and focus on child-centered topics.
Koenig & Farrenkopf, 1997	Qualitative	N/A, 254 stories from three basal literacy series	Analysis of basal stories	Essential early life experiences were identified as being important for young children with visual impairments for bringing meaning to stories in early literacy. Twenty-two global areas of experience are suggested.
Koenig & Holbrook, 2000	Qualitative	40 experienced teachers of braille literacy skills	Surveys	The consistency and intensity of braille literacy instruction will vary depending on the skills being taught. Initial braille literacy skills will need to be taught daily and for lengthy periods over several years.
Landau, Gleitman, & Spelke, 1981	Quantitative	A congenitally blind 2 ½ year-old, and sighted but blindfolded adults & children	Observation	Locomotion of a young blind child was found to be guided by spatial understanding and inferences when the appropriate path between two objects was determined after traveling to each from a third object.
Lusk & Corn, 2006	Mixed Methods	Teachers of the visually impaired children learning both	Questionnaire	Various demographic characteristics of teachers and students using dual media, the decision-making process to use dual media,

		print and braille		and attitudes of parents and teachers are described.
McConachie & Moore, 1994	Mixed Methods	18 blind or severely visually impaired children from London clinics evaluated at age 2 or 3	Test scores and parent diaries	Blind and visually impaired children's expressive language developed later than that of sighted children. While even limited vision in children with visual impairments was evident in early utterances, blind children had a more variable growth.
Minter, Hobson, & Pring, 1991	Quantitative	8 congenitally blind children 6-12 years-old	Test scores	Congenitally blind children were less likely to identify vocal emotion-sounds than sounds of non-emotional objects, likely due to vocal qualities.
Moore & McConachie, 1994	Quantitative	8 blind and 8 severely visually impaired children 13-25 months old	Observation and transcription	Parents of blind children tended to initiate the verbal interactions and tended not to talk about objects to which the child was attending. They described properties of other objects in general terms, and often requested verbal information from their children.
Murphy, Hatton, & Erickson, 2008	Quantitative	192 teachers of young children with visual impairments	Survey	According to this survey, the most approved early literacy practices for children with visual impairments include facilitating early attachment, providing early literacy support to families, and providing adaptations to increase accessibility.
Ochaita & Huertas, 1993	Quantitative	40 blind children, 8-18 years-old	Observation	Age is the determinant in the development of spatial representation in blind people. This ability improves with the beginning of adolescence, perhaps in conjunction with

				abstract and verbal reasoning skills.
Pérez-Pereira & Castro, 1997	Quantitative	Twin sisters, one born blind, one sighted	Observation and transcription	Data from this study show that this blind child did not exhibit delayed or atypical language development as traditionally thought of blind children. Further, language played an important role in the child's early ability to adapt to her environment, socialize, regulate her actions, and compensate for a lack of visual information.
Perez-Pereira & Conti-Ramsden, 2001	Quantitative	3 mothers and their blind young children	Observation, transcription, and coding	Maternal directives given to blind children may be repeated or given in clusters to help the child adapt to tasks or provide the needed verbal information when visual input is absent.
Preisler, 1993	Qualitative	9 blind preschool children	Observation, interview, questionnaire	The behavior of blind children in the preschool setting is markedly different than their sighted peers. Blind children seldom initiate or reciprocate contact with others, and need assistance interpreting unspoken cues or rules and communications with peers.
Pring, 1984	Quantitative	9 congenitally blind children with no other disability	Observation	The low redundancy of braille makes word recognition more difficult than print when both are degraded in quality. In the same degraded condition, understanding from context and semantics increases for the print reader and decreases for the braille reader who is attending predominately upon sensory perceptual decoding.

Pring, 1985	Quantitative	10 congenitally blind children with no other disability, mean age of 12; five congenitally blind students ages 22-30 years; 18 sighted children, mean age of 10	Observation	Sighted children took longer to reject non-words that were pseudo-homonyms (e.g. blue/bloo) than phonetically different words (e.g. brain/prane) than did blind children suggesting the blind do not construct a phonological letter-by-letter code. Lexical decisions by the blind took twice as long as those by sighted due more likely to slow tactual perception than slow information processing.
Raver, 1987	Quantitative	Five congenitally blind children aged 5-8 years	Pre-test and post-test measures	Proper gaze control and sitting posture were taught to five blind children to a pre-determined mastery criterion using physical prompting, social reinforcement, discussion, and feedback. The study found that maintenance training is required to make lasting effect and generalization of behavior.
Sampaio, 1989	Mixed Methods	Five blind children aged 5-48 months	Observation	Children up to the age of four were able to immediately use information obtained from a SonicGuide without preliminary learning.
Segond, Weiss, & Sampaio, 2007	Quantitative	36 sighted infants, mean age of 5 months	Pre-test and post-test measures	Artificial visuotactile stimulation was found to motivate infants' behavior. The study suggests that tactile vision-substitution systems might serve as the lure for distal objects in blind children.
Skellenger & Hill, 1994	Quantitative	Three blind children aged 5-7 years	Pre-test and post-test measures	Shared teacher-child play intervention was effective in increasing targeted age-appropriate play behavior in young blind children across

				both shared-play and spontaneous play settings.
Stauffer, 2008	Quantitative	15 year-old male with a visual impairment & developmental delays	Pre-test and post-test measures	Blind children with additional disabilities learned to read uncontracted braille at a functional level and write using a keyboard equipped braille letters when given guided whole language instruction.
Stuart, 1995	Quantitative	31 congenitally blind children	Test scores	Blind children born premature, with low birth weight, and/or with developmental delay are more at risk of having had focal brain damage affecting that very area that allows people to compensate for their vision loss in spatial function and orientation.
Tait & Wolfgang, 1984	Qualitative	Preschool program director, four teachers and helpers, and mother of a blind 3 year old	Response forms and survey	Staff and parent concerns identified while mainstreaming a blind child in a preschool setting could be summed up in two major problems: passivity of blind child; and peers' view of child as dependent or helpless.
Troster, 2001	Quantitative	51 parents of blind children enrolled in German early intervention centers	Questionnaire	Mothers of children with disabilities experience more stress than those without disabilities, due to a child's impaired functioning and intensive needs, and independent of other variables such as parent age, education or occupation, or family structure.
Troster, Hecker, & Brambring, 1994	Quantitative	10 congenitally blind infants and preschoolers	Observation	Lack of vision is the predominate cause of delay in motor development in full-term blind children. The function of vision in these skills is compensated

				in blind children by auditory and tactile input.
Ungar & Blades, 1997	Mixed Methods	59 blind, visually impaired, and sighted children aged 5-11	Observation, interview, pre-test and post-test measures	Visually impaired children can be taught to calculate distances on a tactile map to help them in mobility tasks and map skills.
Wittenstein,1993	Quantitative	230 teachers of blind and visually impaired students, trained in braille	Survey	Training in braille instruction that emphasizes methodology and tactual perception – and not mere code and rules – tends to promote confidence and retention of skills, and an attitude that braille is essential, complemented but not replaced with adaptive technology.
Zeppuhar & Walls, 1998	Quantitative	37 blind and visual impaired students aged 6-21 years	Test scores	Blind and visually impaired children provided more prototypical examples of a concept with age and degree of sensory experience with that concept. The study indicated that learning concepts is more sensory experience based than language based.

3.2.1. Research design

Thirty-nine of the 53 empirical studies (74%) listed in Table 2 were quantitative studies. Seven (13%) of the studies were qualitative research. Seven (13%) of the studies employed mixed methods.

3.2.2. Participants and data sources

Twelve of the 53 studies (23%) collected data exclusively by observing blind and visually impaired children to describe language development, social participation, locomotion, and braille reading. Ten of the studies (19%) obtained data through test scores, or rating scales, to examine variables in literacy skills, inappropriate behavior, spatial function, concept learning and developmental scores among children with visual impairments. Nine studies (17%) enlisted surveys of teachers or parents of blind children or of school administrators. Six studies (11%) joined observation and testing, and six (11%) used a combination of interviews with field notes, document reviews or other data sources listed here. Five studies (9%) analyzed pre-test and post-test measures on children with visual impairments to determine the effectiveness of various interventions. Four studies (7%) utilized questionnaires to procure the beliefs and practices of professionals and parents of children with visual impairments. One study (2%) did not include participants but analyzed components of basal stories.

3.2.3. Findings of the studies

The findings of the 53 studies included in this review of the literature can be summarized as follows:

1. Residential schools for the blind continue to serve as excellent educational placements, as well as important resources to surrounding schools.

2. Differences in early language development tend to exist between blind and sighted

children due to the lack of visual information, however the use of language plays an important role in the blind child's ability to adapt and compensate for that lack of visual information.

3. The development of children with visual impairments is affected more by early parental intervention than by culture, socioeconomic status (SES) or overall home environment.

4. Atypical or inappropriate behavior among children with visual impairments has correlated more with intellectual function and communication abilities.

5. Parental interaction with their child with visual impairment may positively impact language and sensorimotor development with the quality of responsiveness, appropriateness of directive behavior, and the quality of both control and goal setting behaviors. Pragmatic language development may be hurt by excessive parental control or directiveness.

6. Full-term children with visual impairments are less at risk for additional disabilities than pre-term children with visual impairments, and show a more promising spatial function and response to early interventions.

7. It is possible for even congenitally blind persons to synthesize tactile information to complete a cognitive map to spatially represent an area beyond a mere route or sequence of objects. This ability is most impacted by age, general intellectual ability, cause of blindness, and visual acuity prior to age 3. Additionally, interactive models have proven effective in teaching environmental concepts.

8. Orientation & Mobility (O&M) skill deficits can be distinguished by screening tools for preschoolers with visual impairments. The function of vision in motor development and mobility tasks is compensated by auditory and tactile input skills developed with age and O&M instruction. For example, children with visual impairments can be taught to calculate real distances on a tactile map.

9. Social behavior in blind children is notably more passive, in initiating or reciprocating contact with others, and dependent, for unspoken cues and communication with peers, regardless of setting. Play behavior in children with high developmental scores includes high levels of 'fantasy' play where symbolic use of language is used and symbolic use of objects is not, indicating play in blind children is different and not delayed. Social skills interventions have proven effective in increasing the amount and scope of social and play behavior.

10. Braille instruction that emphasizes methodology and tactual perception, and not mere code and rules, promotes confidence and retention, and an attitude that braille is essential in a time where adaptive technology poses as a replacement to literacy in braille. The Mountbatten Brailler is esteemed as a beneficial tool for early literacy learning, versatile in braille and print. Functional literacy of uncontracted braille has been taught to blind children with additional disabilities using modified keyboards and whole language instruction.

11. Braille readers acquire reading skills at a slower rate than sighted peers and have poorer phonological awareness skills, likely because they do not construct a phonological letter-by-letter code. Braille readers introduced to the 189 braille contractions early on did better in vocabulary and spelling while those exposed to fewer contractions lacked high-level decoding skills.

12. High and low achievers of literacy skills among blind children were not distinguishable in the areas of age, visual impairment etiology, family attitude or behavior toward literacy, class size, or time with a teacher of the visually impaired, but represented a difference in the provision of consistent structured reading instruction. Supporting emerging literacy includes a family-centered approach, language and concept development, and a focus on the senses as they relate to literacy learning. Facilitating early attachment and increasing accessibility were also priority practices.

13. Environmental sensory aids have had no clear impact on the process of sensory integration.

3.3. Emergent themes

Eleven themes emerged from my analysis of the 99 articles included in this review of the literature. These emergent themes include: (a) septo-optic dysplasia and optic nerve hypoplasia; (b) parenting and early intervention; (c) cognitive development; (d) language development; (e) orientation and mobility; (f) social behavior; (g) assistive technology; (h) educational placement; (i) emergent literacy; (j) Braille literacy; and (k) assessment. These 11 theme clusters and their associated formulated meanings are delineated in Table 3.

Table 3

Theme Clusters	Formulated Meanings
Septo-optic Dysplasia & Optic Nerve Hypoplasia	• SOD appears to be a disorder of the embryological development of midline brain structures. • It has been proposed that vascular disruption of blood flow to critical areas in the brain of a developing fetus is the cause of at least some cases of SOD, whether through toxins, trauma, or genetics. • Optic nerve hypoplasia is a congenital abnormality where one or both optic nerves is found to have a reduced amount of axons in which vision can range from 20/20 to the inability to perceive light, though legal blindness occurs in less than ten percent of cases. • The development of optic nerve hypoplasia is thought to occur early in embryogenesis between the sixth and twelfth weeks of gestation when the optic nerve fibers grow along the optic stalk until they meet the midline of the developing brain and are disturbed by abnormalities in these midline brain structures. Optic fibers that are unable to secure synaptic connections to the brain in turn die. • The midline structures in the brain that may be affected by this disorder include the corpus callosum, a band of nerve fibers connecting left and right brain hemispheres, the septum pellucidum, a thin membrane attached to the corpus callosum separating the lateral cavities, and the pituitary body, which secretes hormones to regulate growth and the activity of the thyroid gland. • Even when anomalies are not apparent in these structures, there may be compromise to the central nervous system leading to multiple problems during the peri-natal period. • Though etiology is not certain, it appears that optic nerve hypoplasia is environmentally caused rather than genetic, as it does not run in a family, nor is it caused by infection. • While heavy alcohol use increases the risk slightly, in the majority of cases there is no history of alcohol use. • Young maternal age, maternal smoking, and preterm birth are factors linked to the condition. • Growth Hormone deficiency is the most prominent pituitary hormone deficiency associated with SOD, and is a result of a defective hypothalamus that is not producing Growth Hormone Releasing Hormone despite an otherwise normal pituitary gland. • Endocrine dysfunction also occurs in 50% to 70% of cases, resulting from poor regulation of the pituitary gland. • SOD may also be the cause of seizures, hypoglycemia, and even sudden death when a proper adrenal response to infection or stress is inhibited.

	• Optic nerve hypoplasia has been associated with growth deficiency, mental retardation, seizures, hypoglycemia, motor deficits, and behavioral problems, in addition to mere visual impairment, presenting a more complex educational problem that warrants further research into the disorder's behavioral and learning characteristics. • A precise etiologic diagnosis gives important information for clinically significant treatment decisions. • Children with SOD may exhibit tactile or auditory defensiveness, frustration with transitions, and slowness to process information. They may reach language and motor development milestones later than usual. • The prevalence of optic nerve hypoplasia is believed to be increasing across the United States and Europe. Ophthalmologists in the practice since the 1970s have noticed an increase, and still diagnose the disease the same way today as it was identified first decades ago, with an ophthalmoscope for viewing the optic nerve.
Parenting & Early Intervention	• Environmental aspects known to be predictors of intellectual ability and language skills include appropriate play materials, care giving, intellectual activity, and verbal stimulation. • The necessary accommodations for a blind child in the home are generally secured regardless of different cultural or socioeconomic settings. • Blind children should be included in daily routines in the home, encouraged to touch, smell, taste, and listen to the surrounding environment, and informed of what others are doing in the immediate environment. • Families that tend to see beyond their child's visual impairment often provide the most natural and responsive input, while those that are more devastated by the impairment have more constrained interactions. • Parental rejection or overprotection of blind children can result in their emotional instability or excessive dependence. • Top concerns for parents of visually impaired children include their child's future, household finances, and adequate services. • Parents' perceived need for assistance increases the younger and more severe the vision loss in a child. • Social support is a major need for parents of blind children due to increased stress levels. • A parent's emotional and verbal responsiveness influences the language development of his or her visually impaired child. • The language provided by a caregiver to a blind child is of special importance when visual input is absent and cannot stimulate language and cognitive development. • A mother's positive and sensitive responses to her child correlate

	positively with the child's sensorimotor understanding, social adaptation, and exploration of his or her environment. • Parents may be discouraged from extending a child's utterances or describing an object or phenomena when that child appears disinterested by lack of eye contact, countenance or gesture, or when a child's utterances seem irrelevant or dull; instead, the parent tends to use more imperatives and repetitions resulting in language delay. • Parents do well to heed their child's pace rather than change it; to imitate their child's behavior rather than control it; to become silent when their child turns her gaze away rather than more verbal. • Two factors important to healthy parent-child interactions are the readability of the child and the responsiveness of the parent. • Relying on directives to communicate with blind children, while serving an adaptive role, can delay their language by limiting their own practice of language to this same function of making requests, thus also limiting their opportunity to problem solve creatively and independently. • Families can promote problem-solving and independence in their blind child or sibling by helping him to accomplish his own requests and not doing it for him. • Blind children have more difficulty expressing interest in their environment without gaze direction, resulting in fewer descriptions or child-centered topics in the environment. Hand behavior may indicate a child's interests. • Descriptive language may be discouraged in parents because their blind child's comprehension cannot easily be confirmed. • To promote social interaction and direct a blind child's attention toward others, families can comment on other persons in the environment, identifying their needs, and also encourage responsiveness in conversations. • Written communication is an important part of family life and frustration is inevitable when family members do not know the child's primary medium for reading and writing. • Parents should make a blind child's environment diverse and interesting – both physically and verbally – to encourage child-initiated engagement. • Children with visual impairments have deficits in play skills resulting from lags in developmental domains, including motor, language, and cognitive skills. • Children who do not develop a sense of control over their environment through early play activities have a tendency to withdraw into themselves. • Children with visual impairments were observed spending 56% of their time playing alone, compared to sighted children's 14%. • Visually impaired children show significantly more stereotypical

	behavior in play activity and significantly less functional toy use. • Parents can enhance concept development in their visually impaired child by paying attention to the child's developmental needs in play and assist in making associations between sensory experiences. Play for the child should be adaptive in some way, learning to manipulate and explore and interact with objects and people. • Providing too large of a quantity and variety of appropriate play materials for a visually impaired child may not benefit the child's exploration and manipulation skills, as shorter and less sophisticated play with items may result. • Older siblings and other children appear to have a more significant impact on blind children's play and development than adults whose presence may even isolate the blind children from healthy peer stimulation. • Introducing a new toy or object by label only limits the creative exploration of it, whereas a description and demonstration of its properties and function facilitates learning in the blind child. • Early intervention programs should attend to the unique needs and dynamics of each parent-child dyad, helping a parent set high and appropriate expectations for a child and teaching ideal responding to the child in varying circumstances. • Early intervention practices must be informed by an adequate developmental psychology that is geared toward the child's specific impairment. • More research is needed to determine the developmental patterns for children with visual impairments given that research is inconclusive and that intervention programs are built upon developmental characteristics of children. • Early childhood programs for the visually impaired should be designed to cover all developmental areas with special emphasis on orientation and mobility skills and parent-child interaction. • Full-term and preterm children with visual impairments demonstrate differences in development and response to intervention. • Early intervention for blind infants and their families may best be done in the child's home, coordinating developmental assessment and criterion-based intervention, targeting impairment-specific development particularly in the area of orientation and mobility, and including parent involvement in social intervention and counseling. • Michael Anagnostopoulos, known as Anagnos, established the Kindergarten for the Blind in 1887, a department of the Perkins Institution, based on the work of Friedrich Froebel whose kindergarten curriculum included materials he called gifts and occupations. Gifts were fixed objects such as spheres, triangles, rings or bricks that students manipulated, thus stimulating motor

	and mental development. Occupations were play materials whose form could be transformed with use, such as clay modeling, cardboard cutting, weaving, and the like. Gifts developed students' observation, perception, imagination, dexterity, and reasoning, while the occupations trained children to handle, combine, invent, create, and reconstruct.
Cognitive Development	• Blindness and visual impairment impacts how a child learns, not what he or she learns. • A blind person is information-poor in the sense that what he obtains is less complete, immediate, reliable, testable, or synthesized. • Children with visual impairments receive less information than seeing children, and with less quality, given the inconsistent, fragmented and passive nature of the perceived information. • Children with visual impairments have fewer opportunities than sighted children to practice and verify new sensory information, make connections with prior knowledge, and derive meaning. • Blindness limits a child's range of available experiences, mobility, and interaction with the environment. • While sighted children have spontaneous access to multiple pieces of information, blind children only have sequential access to information causing a greater memory load and more difficulty learning. • Perceptual and cognitive processes occur sequentially in hearing, touch, taste and smell, whereas they occur simultaneously with vision. • Children with visual impairments need repeated exposure to concrete objects before understanding the symbolism in tactile images. • Young blind children may find the speaking of words to be a perceptual experience rather than symbolic language, thus exhibiting echolalic or perseverative language. • Young blind children with higher developmental scores spend time in 'fantasy' play, and though play consists of language and imitation and not symbolic use of objects, the symbolic play in blind children is not deficit but different development. • Vision has a significant role in organizing and interpreting one's environment. • Cognitive domains that are widely affected by visual impairment include abstract thinking, spatial organization, object permanence, object constancy, and cause and effect. • Children develop by acting on their environment and constructing meaning about their world; blind children are not intrinsically passive. • Blindness impacts the development of a child's motor, socialization, and self-help domain with a predictable pattern.

	• Blind children's development is necessarily different having only four senses and cannot be measured or guided by comparison to sighted peers alone. • Analysis of sensory functioning, in addition to comparisons of normal child development, gives a frame of reference for understanding the perceptual, cognitive, and affective development of blind children. • The 'difference' over the 'deficit' conceptualization of blind children's development is key to understanding the way blind children take in and process the world around them, and key for avoiding instruction and materials that build on the sighted person's perceptions rather than the content and mediums more meaningful to the blind person. • Mediation – the attempt a person makes to connect a child with some feature of his environment – occurs at many levels and in many forms, yet is more active, frequent and significant with blind children. • Mediation involves three stages: giving access, prompting exploration, and encouraging interpretation. • Understanding both mediation and the unique development of blind children is key for establishing and applying interventions for these children. • Blind and visually impaired children show greater progress in mobility tasks that have a strong cognitive appeal. • Young blind children with low scores in sensory motor understanding and language spend more playtime in exploration, suggesting the need for exploration to develop in these areas. • An adult's sustained mediation in the blind child's environment, if not carefully employed, can facilitate both his exploration with the world and his dependency and unwillingness to take risks. • Instead of pressing children to move into a different type of play behavior, children should be encouraged and assisted in the direction of their play to benefit development, be it exploration skills, creativity, or symbolic use of objects. • Special strategies and techniques are necessary to teach blind children number sense, which is a type of conceptual reasoning involving flexible computation or estimation of numbers, and quantitative judgment and inference. • Number sense is more a byproduct than a direct goal of instruction and is developed through extended exploration and visualization of numbers in a variety of contexts and interesting environments. These experiences tend to rely more on visual input. • Parents and teachers can help a blind child think about number by asking questions or presenting tasks that give them insight into the understanding of number, or by posing problems during play activities, such as finger activities that deemphasize rote counting.

Language Development	• The different processes for language development observed, and the success of many blind children in learning language appropriately, points to the plasticity of our cognitive system and its ability to compensate for varying abilities in our modalities. • Language acquisition requires contextually placed language input that optimally matches the cognitive capacities of a child. • Language development is not about teaching words so much as it is about providing experiences that demand the use of speech. • The differences in language development between blind and seeing children with no additional disabilities is due to lack of visual perception alone, which informs the child of the 'here and now' pragmatics of language. • Visual input has a here-and-now quality that promotes language acquisition by giving immediate contextual information for making sense of others' speech and immediate feedback of successful communication through gestures and facial expressions, particularly when introducing a new topic. • While seeing children make hypotheses of word meanings and categories from visual input, blind children are acquiring word labels without extended analysis, and consequently are slow to extend their early words to different contexts. • Words taught to and used by blind children may have different referents, relating to different ideas, perceptions, or complete meanings. • Verbal input for blind children is often child-centered and limited to directives or object labels instead of rich descriptions and environmental information that may compensate for their lack of visual input. • Language patterns for parents of children with visual impairments may differ to satisfy the child's need for information about his immediate context and the parent's desire for shared attention. • Maternal directiveness with blind children may be an adaptation of speech for enlisting greater responsiveness in children who are seemingly more passive. • Excessive direction giving or maternal control can have a negative impact on a visually impaired child's language development, whereas quality direction and control have a positive impact. • Blind children may be keener to the properties and patterns of linguistic input, because language has an adaptive function for them and is a more outstanding experience. • Expressive language tends to develop later for blind and severely visually impaired children. • Early vocabularies are similar between blind and sighted children, but are used more like proper nouns for particular objects or stimuli by the blind child.

	• Blind children may imitate phrases in conversation as a strategy for acquiring language. • Despite disadvantages to environmental and verbal input, blind children evidenced an internal motivation to use and understand language.
Orientation & Mobility	• Spatial representation can be synthesized tactilely, without the utility of vision, and new relationships between objects can be inferred from this cognitive map of an area. • Blind children at an early age can understand and utilize metric properties of space, extrapolating new routes between objects that have not before been traveled. • Spatial organization is developed slowly in blind children when limited movement and exploration, not blindness itself, causes a lack of interaction with objects in the environment. • The haptic frame of reference develops more slowly than the visual, which perceives more all at once and allows efficient synthesis of new stimuli, yet in the end is not inferior or less efficient than cognitive mapping achieved by sighted persons. • Blind and sighted persons each progress through three developmental stages – egocentric, fixed, and coordinated – when learning a new spatial environment, utilizing more environmental elements to represent the route the more they travel it and establishing more complex relationships between these elements. • By adolescence blind people can organize a known space in an abstract and coordinated fashion, and well into adolescence they may have totally developed their ability to represent a known environment, though the complexity of the environment may impact this ability. • Age and cognitive competence are more strongly correlated with the ability to represent a space than the learning of or exposure to that space. • The adolescent's developing ability to verbally reason and abstract ideas may serve to specially compensate for a blind youth's lack of vision when solving spatial problems. • Interactive models are effective for teaching children with visual impairments spatial and environmental concepts and for developing orientation and mobility skills through guided discovery, verbal explanations, and play activities. • Interactive models and tactile maps are a safe, convenient, and efficient way to teach environmental features or traffic patterns. • Locomotor delays in visually impaired children may be attributed to a later development of directed reaching and object permanence. • Play areas for visually impaired children should be designed to promote easy access and movement for reinforcing exploration of the environment.

	• A delay in motor skill development has been associated with emotional and behavioral deficits and delays in play and social skills in children with visual impairments. • While children with visual impairments and no other disabilities have the same physical potential as their sighted peers, they often lack opportunities to reach their potential because of an instructor's lowered expectations or frustration in teaching certain skills. • Physical demonstration paired with verbal instruction and feedback is an effective means to teach motor skills and can be achieved with a blind or visually impaired child through physical guidance and tactile modeling. Physical guidance is where an instructor physically assists a student in performing the skill, while tactile modeling is where the student physically explores the instructor's execution of the skill. • Physical guidance should be reduced to tactile prompts and verbal cues after the student understands the skill being taught and the performance expectations. • Because the instructor's touch can be easily misunderstood or the student may be hypersensitive to touch, successful physical guidance and tactile cues should be documented, for example in a student's individualized education plan, so that instruction can be implemented consistently, effectively, and respectfully. • Tactile modeling gives students control of the learning process allowing them to choose the particular component or movement in a skill for which they need information. • The two-touch technique on a long cane offers the blind person protection by warning of obstacles and drop-offs within the space between his shoulders and a single stride. • While the touch technique requires physical and mental abilities and a good deal of instruction and practice, the diagonal-cane technique is simpler and offers enough protection for familiar indoor environments. • Kinesthetic awareness, motor control, mental discipline, and responsibility are important prerequisites to learning to use a cane. • Mobility training at early ages may utilize protective devices such as toys or hula-hoops to allow safe and independent travel with minimal supervision. • The Connecticut Pre-cane is a simple push device constructed of inexpensive half-inch PVC plumbing tubing fitted together into a four-sided frame chest high and shoulder width at the bottom with runners to detect drop offs.
Social Behavior	• Many students who are blind or visually impaired in the inclusive setting are socially isolated, failing to initiate interactions or respond to the initiation cues of others. • When visual information is not available, communication may include problems in establishing a shared focus of attention, an

	understanding of the other's intent, and extensions of a given topic. • Special education for students who are blind or visually impaired must give access to social skill curriculum as well as core general education curriculum. • Blind children both learn differently and perceive their world and social interaction in ways other than sighted peers, thus requiring thoughtful intervention that does not merely replicate social opportunities sighted children understand. • Social interaction skills for blind children may be considered as important as reading skills, yet do not receive the needed attention in current practice. • Modifications given to blind children to compensate for differences in environmental information, spatial knowledge and nonverbal communication may at times act as barriers to social interaction. • Professionals may enhance the social interactions of blind children by teaching them peer culture concepts, assertiveness training, and means for social observation. • While sighted children can observe the context for emotions encountered in their social world, and the related facial expressions and physical gestures, blind children are left to interpret social affect by vocal qualities alone. • Blind children have been shown to have more difficulty recognizing vocal expressions of emotion than the sounds of various objects. • Detecting emotion in conversation is difficult for blind children because they have had limited contextual input accompanying these expressions (e.g., heated emotional situations are not explained, a child's own emotions go undetected and unexplained further removing cues for both sides, and the child is reluctant to ask about emotions in conversations). • Social skills interventions should be long-term, target peer-to-peer competencies across environments, and include parent and school collaboration. • Social skills specific to children with visual impairments include the expression and interpretation of emotional cues and providing feedback according to social discourse rules. • Early intervention toward social integration is key due to the increasing complexity of social requirements with age and less tolerance for off-topic or atypical interaction. • Key for the successful integration of visually impaired and sighted children is the direct training and maintenance of subtle, nonverbal social behaviors, such as appropriate gaze direction in conversation. • Inappropriate behaviors should be examined to determine what communication is being attempted, and subsequent intervention should teach replacement behaviors that communicate appropriately and are equally effective. • The severity of inappropriate and unusual behavior in blind children

	is highly correlated with intellectual function and communication abilities. • Blind children can be preoccupied with their bodies and internal experiences as demonstrated by self-stimulating mannerisms because their world of self is always present. • Manneristic behavior, often exhibited by blind persons, is a repetitive or stereotyped movement that does not appear to achieve any obvious goal. • Manneristic behavior in blind children can be misinterpreted as mental retardation, emotional maladjustment, or autism, and can affect functional and social domains. • Different theories exist as to the causes of manneristic behavior in blind persons, such as environmental deprivation, self-stimulation, physical activity substitutes, or lack of visual feedback. • Different remedial techniques have been attempted to end mannerisms in blind children, such as punishment, relaxation, behavior modification, early stimulation, substitute activity, and consistent reminders. • After the onset of inappropriate mannerisms, these behaviors may be reinforced by the attention of caregivers or peers and then maintained by the control gained of the surrounding environment, or some self-reinforcement. • It is evidence that a blind child's mannerisms are learned behavior when it occurs separate from other engrossing activities such as eating, swinging, or play so as to obtain reinforcement while frustrated, bored or anxious. • As learned behavior, manneristic behavior can be remediated through behavior modification. • Early stimulation and developmentally appropriate sensory-motor play may serve as a preventative therapy to deter perseveration of inappropriate mannerisms in blind children. • A taxonomy of mannerisms is helpful in identifying the body part needing sensory-motor training to reduce the behavior while teaching substitute behavior that is socially appropriate.
Assistive Technology	• Vibrotactile stimulation, obtained through devices such as the modified Optacon or other Tactile Vision Substitution Systems, may provide congenitally blinded children the perceptual information for understanding three-dimensional space. • A Tactile Vision Substitution System can provide spatiotemporal information for exploring one's immediate three dimensional environment, conveying relative size, interposition, perspective transformation, and other perceptual phenomena relating distance and visual angle. • Dynamic patterns of stimulation, resulting from distal movement, may even be presented in real time through vibrotactile instruments, whereas haptic perception may provide only limited understanding

	of a dynamic environment because the person's touch may obstruct the movement, as with a balloon, or be dangerous, as with a flame. • Vibrotactile stimulation has the potential for developing parallel processing in blind persons rather than the serial processing inherent in haptic perception, which requires attention and memory for the synthesis of sequentially processed information. • Further study is needed to examine how vibrotactile information differs from information gained by haptic exploration, and if providing this input to young children reduces developmental lags in spatial cognition. • The effects of environmental sensory aids are still unknown, and the use of such aids has been complicated by professional and programmatic abuse. • Sensory development and intersensory coordination in blind infants needs to be researched further before resuming the use of binaural sensory aids in infancy and early childhood for sensory integration of environmental information. • Adaptive technology training at a young age is preferable for children with visual impairments to mere adaptations of their immediate environments, both because they are more flexible across new environments and they do not isolate from or cause dependence upon others.
Educational Placement	• The educational needs of a child should determine his or her instructional setting and will vary over time with possible changes in vision. • Braille literacy instruction will need to be more intense and consistent in the early years, and then will vary depending on the individual needs and identified skill deficits of each student. Therefore, literacy skills are a primary factor in determining the appropriate placement, or service delivery model. • More than mere academic learning, children with vision impairments require specific instruction in competency-based skills related to their disability for postsecondary education, employment, and independent living. • Braille literacy instruction should be designed upon the identified needs of each student as per specialized assessments. These needs should drive an IEP team's determination of the amount and type of service appropriate to address the given needs, and must be free of logistical or administrative influence. Services also must include the implementation of high quality literacy programs. • Residential schools for the blind, first established in 1829 and prominent into the 1950s, continue to offer comprehensive and specialized education for the individual needs of blind persons in today's world. • Inclusive practices in educating blind children with their seeing peers come from the philosophy that all children have a right to

	remain with their families and in their communities during the course of their education. • Today, approximately 75% of parents send their blind or low vision children to public schools, and 25% to residential schools. Residential schools serve as significant resources for their surrounding local schools. • The most important reasons parents expressed for sending their children to either a local or residential school was a supportive faculty, the school's ability to meet the child's unique needs, make adequate accommodations, and provide an environment for social growth, and the adequacy of trained teachers of students with visual impairments. • Parents chose residential schools for their children more often because the teachers were well trained and familiar with the disability, while parents chose local schools more often because of tolerable distances between home and school, affordability, and parent convenience. • Service delivery for children with visual impairments in local schools requires a collaborative approach among staff. • There is a national shortage of teachers of children with visual impairments, and many lack specialized training for infant or preschool service delivery. • In-service training models have been effective in establishing ongoing state teams to carry out training and collaboration of early childhood and vision service providers. • Evidence does not appear to support the myth that the social skills, self-confidence, and self-determination acquired in residential schools for the blind do not transfer into the sighted community. • Over the last two decades, residential schools for the visually impaired have become regional resource centers for local day schools serving blind children who are now staying at home and being educated in the mainstream with their peers. • Residential schools may provide specialized support services such as preschool, assessment and counseling, professional development, books and equipment loaning, and summer school programming. • Legislation in some states has mandated that residential schools for the blind adopt new roles and responsibilities for supporting education of the blind in mainstream environments. • Many mainstreaming practices lack the necessary physical and social conditions, otherwise present in a separate day school, to make the environment natural and successful for blind children. • Young children with visual impairments risk spending more unoccupied time in mainstream classroom settings than engaged time with teachers or peers when instructional planning, implementation, or evaluation is insufficient. • A child's engagement can be influenced by the physical

	arrangement in a classroom, the relevance of activities and materials, and the interaction between persons in the environment. • Staff roles should be articulated for mediating free playtime for visually impaired children to enhance interaction and teach social skills. • The teacher of students with visual impairment may appropriately spend one to two hours per day, five days a week, instructing a student in braille literacy, structuring classroom supports, and educating the student's educational team in his or her literacy needs. This level of service has been shown to give blind students the same level of achievement as their same-aged sighted peers. • The properly qualified and certified teacher of students with visually impairments must provide the direct instruction in braille literacy skill. Paraprofessional support of literacy instruction should be counted as a supplement to the recommended instructional time. • Prebraille, or early formal literacy skills, require daily experiences of braille and ought to include daily contact with the teacher of students with visual impairments.
Emergent Literacy	• Emergent literacy consists of oral language, print and braille concepts, and metalinguistic (i.e., phonological and syntactical) awareness. • Oral language can be promoted by encouraging children with visual impairments to initiate communication, by following their lead, by giving meaningful descriptive information, and by enlisting meaningful experiences, conversations, and story telling. • Metalinguistic awareness can be promoted by playing rhyming and word sound games and songs, by modeling letter sounds, and by developmentally appropriate activities in writing and spelling. • The congenitally blind child skips the logographic phase of reading of identifying whole words, instead favoring the alphabetic phase, understanding each letter to represent a sound, thus influencing the reading process for him or her. • Emergent braille literacy includes expanding the experiential base for meaning, discovering the potential of communication in symbols and books, and acquiring perceptual-motor skills for reading and writing. • Parents must provide their blind child direct exposure and involvement in the early experiences, routines, and activities common to the sighted child to facilitate a foundation for literacy, the gaining and conveying of meaning through reading and writing. • Shared storybook reading promotes oral language, book concepts, and strong parent-child attachment when incorporated into positive family routines. • Books for promoting reading readiness in blind children should have only one or two lines of both print and its corresponding braille on the same page so that parent and child can read together,

	tracking left to right can be learned easily, and words or sentences can be understood against the whole of the story. • Print books can be adapted to support braille readiness and interest by adding sounds, songs, actions, activities (e.g. story boxes, object calendars or puppets), or tactile stimuli (e.g. toys, models, real objects, textures or outlines). • When exposing children with visual impairments to books that do not have a sensory component, the content should be consistently and repeatedly experienced. • Inventories of braille readiness skills have been developed to assist parents and teachers in identifying skills obtained and skills to target for educational programming that builds literacy skills in a systematic and fun manner. • Reading readiness for blind children includes tactual discrimination and fine motor activities, book orientation and page turning. • Braille readiness is developed when children explore and make meaning of the world, communicate and solve problems with their hands. • Evidence based literacy resources tailored for young children with visual impairments, and not merely adapted from resources made for sighted children, must be developed for teachers of the visually impaired to provide comprehensive intervention in emergent literacy. • While scientific research indicates that code-related interventions provide better reading outcomes, teachers of the blind and visually impaired appear to lack the knowledge or materials required to provide the direct instruction in phonological awareness. • Special care must be taken to ensure that young children who are visually impaired or blind are enjoying enough of the fun and excitement of reading to build the desired environment and foundation for literacy learning. • Literacy is a process that occurs before the first word is read or written, beginning even in infancy, and should be motivated by fun and excitement.
Braille Literacy	• The teaching of braille code should not be separated from reading and writing instruction as if it were a mere communication mode and compensatory skill unless a child has already become literate via print. • The Expanded Core Curriculum for the visually impaired does not give cause to separate communication modes such as print or braille from reading and writing in the curriculum or in instructional practice. • A lack of standardized methods for teaching braille and a lack of quality control to ensure high standards of teaching, negative attitudes toward blind persons and their communication needs, and an emphasis on teaching children with residual vision to read print

	all have contributed to braille illiteracy. • Braille readers may not be proficient spellers because they read more slowly, have less exposure to written words, and less materials available. • Blind children read less well and have poorer phonological awareness than their sighted peers likely due to braille orthography, which does not consistently represent speech sound segments. • Children with and without sight are comparable in their ability to make inferences in stories read or heard. • Blind children have an advantage over seeing peers in answering literal questions from stories presented auditorially. • Experienced braille readers average 70-100 words per minute compared with sighted print readers at just under 300 words per minute. • Reading speed is affected by word length, frequency, repetition, and semantic knowledge in both print and Braille medias. • Generating inferences involves applying general knowledge and linking different sections of a text to fill in missing information. • Working memory handles information with low semantic content more easily, giving advantage to learning literal information through auditory presentation. • Failure to make inferences often is the cause of unsuccessful comprehension, and remedial work targeting inference generation can be more strategic than decoding fluency and comprehension activities. • Phonological awareness can be well developed in blind children despite the lack of word or letter experience. • While there are differences in learning, blind and sighted students both achieve a similar level of reading skills at about the same stage of development. • Preschool teachers express fear and frustration about giving potential braille readers what they need to meet their potential, and the teachers of the visually impaired are often not fluent or practiced in their braille methodology due to its low prevalence in a school district. • A teacher providing reading instruction for a children with visual impairments should be characteristic of a good teacher, able to teach, understanding of language and literacy learning, competent in the codes and media of braille, and knowledgeable of the impact of visual impairment on the acquisition of literacy. • Securing all the needed characteristics and qualifications in a teacher of braille literacy requires training across the specialist areas of literacy and visual impairments. • The consultant model of literacy education for the visually impaired lacks responsive lesson planning, where the teacher of the visually

	impaired develops the instructional program for a child whose performance is observed by a different teacher. • The consultant model of literacy education for the visually impaired lacks specific accountability for instructional failure. • The first letters braille readers learn are those with differing numbers of dots in the braille cell. • Early literacy instruction includes 'sight' vocabulary, phonic skills, writing alphabet letters and contractions – though many contractions in Grade II braille are not phonetic. • Print and braille knowledge can be promoted by giving ready access to a variety of books, involving children in routine and functional reading and writing activities, and allowing print and braille scribbling. • Braille literacy materials that are translated from print editions have been a common cause of difficulty for blind learners. • The development of braille literacy skills must continue through the secondary school years. • Fluent braille reading includes a reading rate, accuracy, and prosody that aids in the comprehension of a text. • Blind students do not acquire reading skills at the same rate as their sighted peers and must increase braille reading efficiency through consistent structured reading instruction. • Listening skills, such as aural-reading and live-reader skills, should not be assumed but taught directly because of their importance to the visually impaired child. • Signature writing skills are important to the blind student and can be introduced in grades three through seven. • The decision to teach dual media, both braille and print, to a child with a visual impairment can be influenced by formal and informal assessments, the child's diagnosis and clinical measures, teacher and parent philosophies, and the child's reading speed and stamina. • Instruction in dual media as equal mediums of literacy is arguably ineffective and unrealistic. It is better to select one reading mode to be primary. • Braille is not independent of print English, and learners of Braille will be careful to become competent in English print for the ability to type. • Braille code and the principles of braille reading do not parallel print code and the principles of print reading, thus teaching strategies for the one are not equivalent with those strategies for the other. • Early introduction of braille contractions may benefit early readers in allowing them to take in more text and process information faster, keeping familiar words from being taught in two forms, and recognize words faster.

	• Unlike print, braille script has low redundancy because each dot in a letter is essential to a correct identification of it, which results in a greater demand of the blind student's attention toward feature-analysis and perception of the braille cells leaving less capacity for phonological analysis. • Braille has some drawbacks as a medium for literacy, including the use of contractions, which lack a phonetic correspondence, the successive nature of tactile reading versus visual identification of several letters simultaneously, and the frequency of errors when moving over and misreading dots. • Braille readers make half their errors while reading contractions that occupy two braille cells. • When selecting braillers and other educational devices for the visually impaired student, teachers should consider its impact on students' skills in reading and writing, basic computer, and braille note taking, as well as the students' interaction with peers and teachers. • Opponents of electronic braillers in early literacy argue that young children with visual impairments need immediate access to hard copies of their work, the extra finger strength of the old Perkins Brailler, and the ability to use a low-technology option if the need arise later. • Technology skills are essential to independence. Keyboarding and word-processing should begin in grades one, two, or three. • Slate-and-stylus skills are widely supported among professionals in the field of visual impairments for being well liked by students, cheap, quiet, portable, and available despite technology failure. While the slate-and-stylus can be introduced early, skills should be formally taught at grade three or four.
Assessment	• Blind children are typically given assessments developed for sighted populations and administered by persons who are not visual impairment specialists. • Special care must be taken when modifying assessments for children with visual impairments to make them accessible without affecting the validity or purpose of a test. • Factors to consider when selecting modifications include the nature of the visual impairment, other disabilities that may be present, and the test's presentation and response formats. • Assessment of students with visual impairments consistently underestimates performance, given that some exposure, experience or elaboration with a particular topic may not have yet occurred. • Appropriate assessment tools for children with visual impairments that do not inhibit a child's performance lack in number and quality, and need to be developed for all developmental areas as well as functional vision.

4. Discussion

In this section, I summarize the major themes that emerged from my analysis of the 99 articles included in this review of the literature. I connect these emergent themes both to my role as a parent of a blind child and to my practice as a special educator.

4.1. Septo-optic dysplasia and optic nerve hypoplasia

ONH appears to be increasing in prevalence over the last three decades. ONH is a condition in which the optic nerve has been underdeveloped and contains a reduced amount of axons, causing varying degrees of visual impairment, even blindness, in one or both eyes. It is detected simply by examining the optic nerve using an ophthalmoscope. SOD is the diagnosis given an individual who has both ONH and an absent septum pellucidum, the membrane separating the left and right ventricle in the brain, as detected by an MRI even in infancy. SOD, then, has been the term used to indicate the disorder of the embryological development of midline brain structures. A third area impacted by this disorder is the pituitary gland, also in the midline of the brain, which regulates hormone production for growth or thyroid function. ONH is becoming an interchangeable term with SOD, however, given the shared etiology for both the underdeveloped optic nerves and midline brain structures. The condition develops between the sixth and twelfth week of gestation, likely due to environmental factors such as toxins or trauma. Young maternal age, maternal smoking and preterm birth are also factors that have been linked with the condition. SOD may inhibit a proper adrenal response to infection or stress, thus causing seizures, hypoglycemia, and even sudden death. While the educational literature on the subject of SOD is limited, it has been noted to be a growing complex educational problem. Children with SOD may exhibit several behaviors requiring special education, including tactile or auditory

defensiveness, difficulty with language and motor development, a slower processing of information, and frustration with transitions.

There is a great variability of special needs among children with SOD, both medically and educationally. I look forward to many challenges ahead advocating for a son with SOD. Most of this paper, and the vast majority of literature reviewed herein, addresses only the needs related to his blindness. During the course of this thesis work, however, I have experienced more of the medical needs attributed to his condition: daily Growth Hormone shots, quarterly visits to distant endocrine specialists, respiratory medicines, insatiable thirst and wetting, and the constant monitoring of his response to illness or stress. It is difficult to know how these things may develop in subsequent years. Understanding SOD has put me in an advantaged place to prepare for what may come as both parent and educator of a blind child with potential medical and cognitive impairments.

4.2. Parenting and early intervention

Parents and specialists must be mindful of a visually impaired child's unique developmental needs when planning appropriate early interventions and interactions with the child. These strategies should target such environmental aspects as play materials, care giving, intellectual engagement, and verbal stimulation. Parents and families have the largest role in providing natural and responsive input in the daily routines of the home, stimulating the blind child to interact with and understand the environment around him or her through touch, smell, taste, sound, and language. A parent's emotional and verbal responsiveness is particularly important when visual input does not exist to help language and concept development. A blind child can appear disinterested with no gaze direction or peculiar gestures, and care should be taken to avoid excessive imperatives and repetitions at the cost of descriptive language that might extend

a child's utterances or provide context to the object or person of interest. The readability of the child and the responsiveness of the parent underlie healthy interactions between the two. Observing blind children's play may indicate their current developmental needs and inform parents toward a more enriching environment that both facilitates associations between sensory experiences and enhances adaptive skills. Children without a sense of control over their environment early in play tend to withdraw into themselves. Older siblings and other children appear to have a greater impact on a blind child's play and development than adults whose intervention may further isolate them from their peers. Interventions, carried out by an adult, sibling or peer, should be both informed by the developmental patterns of blind children and driven by high and appropriate expectations of the child. Developmental assessment and criterion-based intervention may best be done in the home.

The most helpful resource that I have encountered in our foster child's early intervention services is a criterion-referenced assessment that inventories the major skills needed by a blind or visually impaired child. The tool offers a developmental sequence of skills arranged in age categories, and provides a platform from which long and short-term objectives may be determined for an individual. Without such a sequenced inventory of skills, it would be difficult to gauge the most pertinent activities for our child's current developmental needs. Additionally, our own creativity of play materials and activities is inspired by such an inventory, as well as by other books, blogs, and social networks. While I have found it difficult to read my child's interests at any given moment, I am learning how to interpret his hand activity and facial cues to determine where his attention is being directed. Our large and active family is also an apparent benefit in capturing or directing his attention. His siblings know what skills he is developing and

play toward the achievement of those skills, proud to be the first to announce the next developmental success to all the family.

4.3. Cognitive development

Blindness and visual impairment in children affects how they learn, not what they learn. Atypical developmental patterns exist among blind children on account of the different input they receive from their environments. A blind child is information-poor, being limited in the information he or she can obtain from the environment in a short time. Information is less complete, immediate, reliable, testable, and synthesized. As a result, these children have fewer opportunities to make connections between sensory information in their environment and prior experience or knowledge. While sighted children perceive multiple pieces of information at one time, blind children may only access information sequentially, demanding more memory in the learning process. These learning disadvantages delay many developmental milestones. Symbolism, for example, is understood only after repeated exposure to the concrete object symbolized in a tactile image. Spoken words, also serving as symbols, may not have the correct referent or meaning intended when they were taught, or they may serve the child more as a perceptual experience even resulting in echolalic or perseverative language. Other cognitive domains widely affected by visual impairment include abstract thinking, spatial organization, object permanence, and cause and effect. Blindness impacts these areas in a predictable pattern, however, and intervention is improving with further research into these exact patterns. Indeed, instruction and materials for blind or visually impaired children should not build on the developmental patterns of the sighted, at least without an analysis of sensory function in the lesson. A parent or teacher must mediate between a blind child and features of his or her environment more actively and frequently than might be necessary for sighted students. This

mediation gives the child access to materials or parts of an environment, prompts exploration, and encourages interpretation. Motivation to interact with an environment correlates with the cognitive appeal of an activity, evidenced in a child's play behavior. Without care, an adult's prolonged mediation may inhibit a child's free exploration and willingness to take risks. Instead of directing a child toward different play behaviors, his or her independent play may be assisted to benefit the developmental needs and motivations inherent in them.

Cognitive development is an area of particular interest for us as we watch our blind son grow. Though diagnosed with SOD, it will be difficult to determine for certain the presence and severity of a cognitive impairment for several more years given the delayed and atypical developmental patterns for a child completely blind. We study his play behaviors and notice, with seven pairs of working eyes in the family, every new nuance of skill or exploration. He receives constant encouragement and praise. Though I have not perceived an excess of this, special attention is warranted to avoid excessive mediation on the part of parent or child in the family, making access too effortless, risk too failure-proof, exploration too passive, and synthesis too distant. It is difficult to know what he comprehends until he demonstrates some new competency acquired through frequent exposure to an experience or set of objects. Still this evidence comes after significant mediation that had yet to yield any sign of understanding. Many a journal article on this topic had called for further research into the predictable patterns of development common to blind children who did not also suffer from additional disabilities. Certainly, it will be vital to follow the current research on these patterns and adjust intervention to his exact developmental needs.

4.4. Language development

Differences in language development between blind and seeing children have long been noted. Excluding the presence of additional disabilities, the cause of this difference is strictly the absence of visual input for the blind children. Visual perception affords the 'here and now' pragmatics of language, giving immediate contextual information for language received as well as feedback for language spoken to others. Blind children learn word labels without extended analysis while children with sight have opportunity to hypothesize and categorize word meanings across various contexts, thus extending words before their same age blind peers. While vocabularies are similar between blind and sighted children, the former use these words more like proper nouns for objects or stimuli. Expressive language tends to develop later for blind children, and early utterances may be more imitative as a means of acquiring new language. Language acquisition requires contextually placed language input, which is more of a challenge for blind children who perceive limited amounts of a given environment. Thus, verbal input has been the subject of much study, even as it provides an adaptive function for children relying on their hearing to navigate an environment. Maternal language use with blind children has been studied and has shown more directives are given to blind children than sighted children. While excessive direction giving may in turn withhold the descriptive language a child needs to understand features of the larger environment, maternal directiveness does serve to provide the child with needed environmental information and sustains a shared attention and responsiveness between the mother and child. For this reason, language patterns for parents of children who are blind or visually impaired may differ purposefully. Despite these disadvantages to environmental and verbal input, blind children show consistent motivation to use and understand language. Indeed, blind children may have a keener sense of the properties and patterns of language because it holds an adaptive function and because its linguistic features stand out more as an

experience for them. It has been observed that language can develop differently between individuals, and with the success that many blind children have shown learning language appropriately, there can be confidence in the plasticity of our brains to compensate for the difference in modalities.

With a good deal of variability in the development of language in our first five children, we remain hopeful in the plasticity of our blind son's cognitive system to compensate for his lack of vision. There is a clear delay even now, which reminds us of the concern for any mild cognitive impairment also weighing in on his delayed language. Nonetheless, our objectives remain the same for promoting his use of language. While descriptive language abounds in the house with verbal siblings, innumerous read-alouds, and a steady stream of songs and lyrics, it is everyone's business to put language in the context of his present experience. When he is eating, the texture and smell and food source or prep may be described. When he is playing with a toy or sibling, the features and actions of both are described. When he is exploring a new object, its function and application are modeled and described with language. More importantly, perhaps, is not the modeling and teaching of words but the provision of experiences that call on his internal motivation to use language or sign he has been taught. A taste of ice cream at the parlor followed by a long silence has finally elicited a clap, which is his version of signing the word 'more'. A lack of assistance in the high chair at meal time until he approximates the word 'help' or picks up his spoon located for him draws on a natural motivation, at least at the beginning of each meal. Fussing and grunting is ignored while key words and signs are taught.

4.5. Orientation and mobility

Efficient spatial representation in blind persons is vital for successful, independent navigation. This cognitive mapping of space can be synthesized tactilely, in the absence of

vision, to infer new relationships between objects. Blind children at an early age have shown that they can understand the metric properties of space and find new routes between objects not yet traveled. This spatial organization develops more slowly in blind children, however, due in particular to their limited mobility to explore and perceive an environment. In fact, blind and sighted children both progress through the same developmental stages when learning a new spatial environment from simple navigation to more complex representation of its elements. Age and intellect have a greater play on this ability than actual exposure to the space, and by adolescence blind persons may have totally developed the ability to represent a known environment as well as solve spatial problems using abstract ideas and verbal reasoning. Interactive models have shown to be effective in safely developing orientation and mobility skills through guided discovery, verbal explanation, and play. Locomotor delays in blind children can be attributed to the late understanding of object permanence and reaching behavior. Consequently, play areas for young visually impaired children should be set up to access a variety of environmental stimuli and provide for ease of movement. Delays in motor skill development may have their impact on other deficit areas common to visually impaired children, including emotional, behavioral, and social skill development. Care must be taken to ensure that children meet their physical potential and teacher or parent expectations of them are not lowered for specific skills. These motor skills may be taught to blind children using physical guidance, where an instructor assists the child in performing the skill, or tactile modeling, in which the child physically explores the instructor's execution of the skill. Verbal instruction should accompany both techniques, which in turn should be faded to verbal and tactile cues. Early mobility training may include the use of push toys, carts, hula hoops, or other home made push devices to promote safe and independent travel. Prerequisites to learning the caning techniques

that would follow include kinesthetic awareness, motor control, mental discipline, and responsibility. The two-touch technique on a long cane offers the greatest protection from obstacles and drop-offs within shoulder width, even allowing a full stride when walking. The diagonal-cane technique is simpler, however, and is often taught first for navigating familiar indoor environments.

We have seen our foster son advance through the initial orientation and mobility skills, and envision a long road still ahead. Certainly, our motivation in this important domain seems timeless. Presently, he is too large to be picking up and setting down and carrying about everywhere, while looking forward we dream of a fellow outdoorsman accessing all the favorite pastimes of the family, navigating the Alaska frontier and telling us all about what we do not see. We have seen him graduate from the laundry basket containing his favorite toys zip-tied along the inside, on to the circular carpet, and then on to the great room floor at large, rolling and scooting without aim yet finding his mark. Several types of swings, indoors and out, a trampoline and a rocking horse all have met his fancy and continue to do so. Now he is independently walking a solid Red Rider cart about the house to experience its bounds and obstacles. Soon he will walk independently with a push toy or PVC tubing fitted together into a four-sided frame with runners. Meanwhile, we give physical guidance and explain the actions of various self-help and play behaviors to encourage independence and social initiation. Indeed, we look forward with expectation of learning new techniques and coaching him in skiing, biking, rock climbing, fly fishing and futsol.

4.6. Social behavior

Many blind or visually impaired students placed in inclusive settings remain socially isolated. They fail to initiate interactions with others or respond to the initiation cues of others

reaching out to them. Without the visual information in these social attempts, it is difficult for the blind child to have a shared focus of attention, an understanding of the other's intent, and natural opportunities to extend the given topic. Social skills for the blind child can be considered as important as reading skills, though they have received inadequate emphasis in practice. Special education for students who are blind or visually impaired must give access to social skill curriculum as well as core general education curriculum. This instruction must be specialized to meet the unique learning needs of blind children and not merely replicate social opportunities sighted peers understand. Side stepping the instruction with modifications intended for blind children to compensate for disadvantages in perceiving environmental information, nonverbal communication, or spatial knowledge, may actually introduce barriers to social interaction. Blind children need to be taught peer culture concepts, assertiveness training, and different means for social observation. Detecting emotions in the social setting is another challenge for the blind child. Facial expressions and physical gestures related to emotional content escape the attention of blind individuals, who in turn are left to interpret social affect by vocal qualities alone. Yet studies have shown that blind children have more difficulty recognizing vocal expressions of emotion than the sounds of various objects. This difficulty stems from several potential factors including a lack of real experience discussing emotions since heated emotional situations are not explained typically, and a blind child may be reluctant to ask about emotional expressions. Social skills needed by blind children include the expression and interpretation of emotional cues, and providing feedback according to social discourse rules. Interventions for developing social skills should target peer-to-peer competencies across different environments. They should be long-term and include collaboration between school and parent. Early intervention should be attempted as social requirements in peer interactions become more complex with age, and

tolerance for atypical or off-topic interaction lessens. Blind children may be taught subtle, nonverbal social behaviors such as appropriate gaze direction. Often other inappropriate behaviors or mannerisms also interfere with healthy social engagement, the severity of which is highly correlated with intellectual function and communication abilities. Repetitive or stereotyped movement, not appearing to achieve any obvious goal, can be misinterpreted as cognitive impairment, autism, or emotional maladjustment, and may affect a child's functional and social domains. Different theories exist for the cause of manneristic behavior, and different remedial techniques have also been attempted. Most often these are learned behaviors with some function, be it internal comforts, attention, communication or control. Replacement behaviors can

I have had to study my boy's face carefully for indication of what he is attending during our interactions. He will need to be taught specific nonverbal behaviors for cueing his partners in conversation, including gaze direction and an occasional head nod. He shows interest in social exchanges with his siblings initiating interaction by touch or grunt. These early interventions are promising with hopes that his motivation will continue, even across settings and peers, despite the increasing demand for more complex social behavior. We address his emotional responses to things with verbal description and empathy, and he has been responsive to stop fussing when we direct him. Still it will be good to be mindful of the emotional cues that may help him interpret his interactions with others. Our child has had few mannerisms that have been distracting or unsafe. Because he has no light perception the eye poking behavior more common to the visually impaired child has not tempted him. We discourage him from repeatedly tapping his head, which appears to be a sensory stimulation for his hands and head. And when he simply shakes his arms with limp wrists, in what appears to be excitement, we redirect his hands to the item or person

that may have been a source for this emotion. We expect these mannerisms to fade, though maybe with some instruction, since they are sensory oriented and can be replaced by other more socially appropriate or subtle behaviors.

4.7. Assistive technology

While the most popular assistive devices for the blind remain to be the white cane or guide dog, and braille displays or audio books, new assistive technology is continually being developed. Vibrotactile stimulation, provided through various Tactile Vision Substitution Systems worn or carried on the blind person and utilizing some type of camera and tactile display, may provide congenitally blinded children the perceptual information for understanding three-dimensional space. It has the potential for developing parallel processing in blind persons over and above the serial processing inherent in haptic perception, which requires attention and memory for the synthesis of sequentially processed information. A Tactile Vision Substitution System may even provide the spatiotemporal information needed to explore the immediate three-dimensional environment, conveying perceptual phenomena that relate information about distance and visual angle, including relative size, interposition, and perspective transformation. The dynamic environment may even be presented in real time through these instruments when distal movement captured via the device's camera triggers dynamic patterns of stimulation. This holds potential advantages over haptic perception when the blind observers touch actually obstructs the movement, as with a balloon, or is dangerous, as with a flame. Further research is ongoing to determine what advantages this input may have for young blind children for reducing developmental lags in spatial cognition. Binaural sensory aids, where visual information is translated to auditory information, have also been developing since the SonicGuide was introduced in the mid seventies. The effects of environmental sensory aids are still largely

unknown, and the use of such aids has been complicated by professional and programmatic abuse. As a result, much of the sensory development research with blind infants has been discontinued until more is understood. Still, adaptive technology training at a young age is preferable to mere adaptations of the immediate environment, because the children are both more flexible across new environments and less isolated from or dependent upon others.

Adaptive technologies have been smoothly introduced in our home with thanks to the services available to us. Braille labels are dispersed through the house on items our son touches everyday and in our collection of children's books, and mobility devices such as his cart and push toy are being used everyday with the goal of access and independence. Training in braille and the white cane will be priority adaptive technologies for him. However, the importance of keeping current with the rapidly advancing assistive technology is clear to me. Viable solutions are being offered through assistive technology to open access up for the blind person, especially in reading, computer, and mobility tasks.

4.8. Educational placement

Instructional settings should be determined by a student's educational needs. Two service delivery models that are most frequently considered for blind children are the inclusive model occurring in a local school, and the separate day school or residential school. First established in 1829, the residential schools for the blind have been prominent into the 1950s and continue to offer comprehensive and specialized education for individual needs of blind persons in today's world. Today, approximately 75% of parents send their blind or low vision children to public schools, and 25% to residential schools. The opposite was true in the 1950s. Inclusive practices in educating blind children with their seeing peers come from the philosophy that all children have a right to remain with their families and in their communities during the course of their

education. Residential schools now serve as significant resources for their surrounding local schools. Choosing the appropriate educational placement must take into account several potential needs of the child including literacy skills and competency-based skills related to their disability that impact postsecondary education, employment, and independent living. The most important reasons parents expressed for sending their children to either a local or residential school was a supportive faculty, the school's ability to meet the child's unique needs, make adequate accommodations, provide an environment for social growth, and the adequacy of trained teachers of students with visual impairments. Generally, parents chose residential schools more often because teachers will well trained and familiar with the disability, and they chose local schools more often because of tolerable distances between home and school, affordability, and parent convenience. Certainly, quality service delivery in the local school requires a collaborative approach among staff. When instructional planning, implementation, or evaluation is insufficient, children with visual impairments risk spending excessive unoccupied time in the mainstream classroom. A child's engagement can be influenced by the physical arrangement in a classroom, the relevance of activities and materials, and the interaction between persons in the environment. While there is a national shortage of teachers of children with visual impairments, in-service training models have been effective in establishing ongoing state teams to carry out training and collaboration of early childhood and vision service providers. Yet an adequate level of service for blind children, giving them comparable achievement as their same-aged peers, may include the visual impairment teacher one or two hours per day, five days a week, instructing a student in Braille literacy, structuring classroom supports, and educating the student's educational team in his or her literacy needs. On the other hand, evidence does not appear to support the myth that the social skills, self-confidence, and self-determination acquired in

residential schools for the blind do not transfer into the sighted community. Residential schools have increasingly provided specialized support services such as preschool, assessment and counseling, professional development, books and equipment loaning, and summer school programming. Legislation in some states has even mandated that these schools redefine their roles and responsibilities for supporting blind children in the mainstream.

I have considered this information about residential and local school placements carefully, and anticipate revisiting it from year to year. Our blind child's needs will change over time and new assessments will indicate new instructional needs, though it is doubtful that his actual vision will change as with other visual impairments. All the same, variables in our home and local schools may change. We live in a city that does not have a residential school for the blind, and services may not be as readily available here. Still, we hold to the value of family for all children regardless of disability. We would move away to needed services if necessary, but remain confident in the ability to adapt our family's own physical and social conditions to provide our blind member with all he needs.

4.9. Emergent literacy

Literacy is a process that occurs before the first word is read or written, beginning even in infancy, and should be motivated by fun and excitement. Emergent literacy consists of oral language, print and braille concepts, and metalinguistic (i.e., phonological and syntactical) awareness. It also includes expanding the experiential base for meaning, discovering the potential of communication in symbols and books, and acquiring perceptual-motor skills for reading and writing. Oral reading can be promoted by encouraging children with visual impairments to initiate communication, by following their lead, by giving meaningful descriptive information, and by enlisting meaningful experiences, conversations, and story telling. Print and

braille concepts can be promoted by adapting print books with such things as sounds, songs, actions, activities, or tactile stimuli. Otherwise, books without these sensory dimensions should cover content well known and experienced by the blind child. Other books might have only one or two lines of both print and its corresponding braille on the same page so that parent and child can read together, easily learn tracking left to right, and understand words or sentences against the whole story. These activities should also include for the blind child tactual discrimination and fine motor activities, book orientation and page turning. Finally, metalinguistic awareness can be promoted by playing rhyming and word sound games and songs, by modeling letter sounds, and by developmentally appropriate activities in writing and spelling. The congenitally blind child skips the logographic phase of reading, identifying whole words, and favors instead the alphabetic phase, understanding each letter to represent a sound. This trend, along with the scientific research behind code-related interventions and the weakness of these skills in young blind children, point to the need for curriculum that provides direct instruction in phonological awareness for the blind child learning braille, and not merely adapted from resources made for sighted children.

In our child's early stage of emergent literacy, the family is working in the areas of oral language and print and braille concepts. Communication is flowing in our airwaves all the time, so much so that we have to protect his quieter acoustical settings as well. Someone is usually conversing with him throughout the day. Transforming these interactions into meaningful and descriptive language will be an ongoing process. It will be fruitful to consider even with the other children some of the themes they see in our collection of children's books, and then translate them into the component objects and experiences that give them understanding of the theme. From there we might brainstorm activities to bring these experiences to their blind

sibling. The family is learning braille this year and all are excited to incorporate it into the daily routine, happy to find something new to label with the clear braille adhesive created on our Perkins APH Brailler. Fortunately, I have found Grade I Braille easy to learn already. It will be easy enough to keep up for the next few years typing new labels and translations in new children's books, however the literacy instruction for our child will be particularly challenging. I am hopeful that the Hadley School for the Blind professional studies courses and resources will be adequate to meet this need.

4.10. Braille literacy

The teaching of braille code should not be separated from reading and writing instruction unless a child has already become literate via print. Braille should not be seen as if it were a mere communication mode and compensatory skill when it is the prime media for acquiring literacy. Braille literacy has been declining in recent years due to several factors. Some have attributed this decline to a lack of standardized methods for teaching braille and a lack of quality control to ensure high standards of teaching, to negative attitudes toward blind persons and their communication needs, and to an emphasis on teaching children with residual vision to read print. Additionally, audio books and other assistive technology have become more accessible for accommodating the needs of visually impaired children without their own literacy skills. While there are differences in learning, blind and sighted students both achieve a similar level of reading skills at about the same stage of development. Braille readers are known to be poorer spellers and slower readers at one-third the rate of sighted readers, but are comparable to sighted readers in literal and inferential comprehension skill development. Phonological awareness can be well developed in blind children despite the lack of word or letter experience. Preschool teachers express fear and frustration about giving potential braille readers what they need to meet

their potential, and the teachers of the visually impaired are often not fluent or practiced in their braille methodology due to its low prevalence in a school district. A teacher providing reading instruction for a children with visual impairments should be characteristic of a good teacher, able to teach, understanding of language and literacy learning, competent in the codes and media of braille, and knowledgeable of the impact of visual impairment on the acquisition of literacy. Meanwhile, the consultant model of literacy education for the visually impaired lacks responsive lesson planning, where the teacher of the visually impaired develops the instructional program for a child whose performance is observed by a different teacher. The model may also lack specific accountability for instructional failure. Early literacy instruction includes 'sight' vocabulary, phonic skills, and writing alphabet letters and contractions, though many contractions in Grade II braille are not phonetic. The development of these braille literacy skills will then continue through the secondary school years. Braille literacy materials that are translated from print editions have been a common cause of difficulty for blind learners. The decision to teach dual media, both braille and print, to a child with a visual impairment can be influenced by assessments, the child's diagnosis and clinical measures, teacher and parent philosophies, and the child's reading speed and stamina. However, it is ineffective and unrealistic to teach dual media as equal mediums of literacy, and one reading mode should be selected to be primary. Still, while braille is not independent of print English, competence in English print provides for the ability to type on a QWERTY keyboard. Braille itself has some drawbacks as a medium for literacy, most obvious being the use of contractions, which lack a phonetic correspondence. Additional drawbacks include the successive nature of tactile reading versus visual identification of several letters simultaneously, and the low redundancy of the braille script demanding more of the readers attention toward feature-analysis and perception of

braille cells, thus leaving less capacity for phonological analysis. When selecting braillers and other educational devices, teachers should consider its impact on the student's skills in reading and writing, basic computer, braille note-taking, and his or her interactions with peers and teachers. Non-electric braillers and slate-and-stylus instruments continue to be found favorable given that they can function in all settings, give immediate access to hard copies, and offer quiet and inexpensive access to writing media.

I am interested in seeing potential literacy curricula written for the blind student. I would like to be proficient in identifying those instructional programs that merely adapt literacy curriculum written for sighted students. My wife and I will seek training opportunities in the areas of literacy and blindness, as well as Braille. Excluding the possibility of cognitive impairment or additional learning problems, the pathway to braille literacy for our son looks similar to that for our other children. We have had the privilege as a family to meet a charming and exemplary blind nine-year-old girl elsewhere in the state, and her mother. She read to our children from her electronic refreshable braille device at speeds that surpassed my own read aloud rate and accuracy at the end of workday. We are certainly very excited about literacy in our home, particularly in the unplugged fashion.

4.11. Assessment

Blind children are typically given assessments developed for sighted populations and administered by persons who are not visual impairment specialists. Modifying these assessments for visually impaired students should be done with care, making them accessible without affecting the validity or purpose of the test. When selecting modifications, factors that should be considered include the nature of the visual impairment, other disabilities that may be present, and the test's presentation and response formats. Still, assessments of students with visual

impairments consistently underestimate their performance due to the fact that some exposure, experience or elaboration with a particular topic may not have occurred yet. Appropriate assessment tools that do not inhibit a visually impaired child's performance are scarce in number and quality. More need to be developed for all developmental areas as well as for functional vision.

While assessments are not the final word for determining a child's ability or achievement, they are helpful for informing educational decisions. Given the ease by which a modified test can prove invalid, our critical thinking of certain assessment results will need developing. Understanding potential modifications and test formats will help us glean important information from assessment data and rule out invalid data. Skills inventories and competency-based assessments will continue to be essential in determining educational needs for our child.

5. Conclusion

SOD is a disorder of the midline brain structures affecting the optic nerve, the pituitary gland, and the septum pellucidum and corpus callosum to varying degrees. Its impact on children runs the continuum of possibilities with visual impairment, hormone deficiencies, and learning disorders, all of which directly impact educational practices for these individuals. It is believed that the prevalence of children with SOD is increasing. Optic nerve hypoplasia is the third most common cause of visual impairment in the country. Visual impairments have a sweeping effect on a child's educational needs. Broadly, a lack of vision impacts a child's social and spatial domains, cognitive and language development, literacy, and mobility.

All the more it is imperative that the educational field as well as the medical understands the disorder. As I get to know my own blind son, the nature of his disorder is an important frame from which to hang all that I am learning about him. It serves as a reference point from which to

investigate his developmental needs and the instructional strategies I might employ to meet those needs. Likewise, the nature of his congenital visual impairment helps me understand what to expect of his educational needs. The scope of this paper has been invaluable for laying out this comprehensive frame early in our son's life. It is my hope that I can continue to build from this foundation expertise in the fields of visual impairment, O&M, braille literacy, and assistive technology.

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