Brief Review

Special Education in Childhood Blindness and Visual Impairment: A Review of Current Evidence

Athanasia Zourou[1], Dionysios Palermos[2], Theodoros N.Sergentanis[2], Konstantinos Kotrokois[2]

[1]*School of Education, Department of Education, University of Nicosia*

[2]*School of Public Health, Department of Public Health Policy, University of West Attica, Athens University Campus*

ABSTRACT

Purpose: To review the principles, educational needs, and evidence-based methods relevant to special education for children and adolescents with blindness, visual impairment, and vision loss.

Methods: A narrative review was performed in Pubmed and Google Scholar, prioritizing systematic reviews, clinical reports, qualitative studies, and key original studies on early intervention, literacy, psychosocial development, assistive technology, cerebral visual impairment, and school participation in childhood and adolescence.

Results: We found that special education for learners with visual impairment must begin early and should not be limited to medical diagnosis. Effective support strategies primarily depend on developmental monitoring, family-centered intervention, individualized literacy planning, access to braille and low-vision tools, assistive technology, and school environments that promote participation and psychosocial well-being. Emerging evidence also shows that cerebral visual impairment is common, under-recognized in schools, and can significantly hinder education. Teacher awareness, interdisciplinary collaboration, and timely correction of treatable vision problems can lead to better access to learning and participation.

Conclusions: Special education in childhood visual impairment is most effective when it is employed early, and has an individualized, literacy-focused, and technologically enabled approach, while also being attentive to mental health and social inclusion. Important gaps remain in high-quality intervention studies, long-term educational outcomes, and implementation research across diverse school systems.

KEY WORDS: Blindness, visual impairment, low vision, special education, education

Corresponding Author: Athanasia Zourou,
email:athanasiazourou727@gmail.com

Introduction

Childhood blindness and visual impairment constitute important developmental and educational conditions; however, their epidemiology varies strongly by region, income level, and cause (1-3). It is also consistently emphasized that it is not a homogeneous population, as some children have isolated ocular disorders, while others have low vision with usable residual sight, and many have additional neurological, cognitive, or systemic conditions which influence educational needs and prognosis (2, 3). For that reason, special education in visual impairment is currently not considered a uniform package of accommodations, but rather an individualized process that links visual function, development, communication, literacy, mobility, and participation (4).

The educational implications of childhood vision loss emerge early in development. Reviews of early intervention claim that developmental surveillance for children with visual impairment must extend beyond milestone checklists designed for sighted children, as visual loss significantly reshapes social referencing, shared attention, exploration, and access to incidental learning (5, 6). Practically, this means that special education should start well before school entry, beginning in infancy through family guidance, environmental adaptation, support for communication and play, and decisions about how the child will access information most efficiently (5-7).

Material and Method

A narrative review was performed in Pubmed and Google Scholar, from 01 March to 31 May 2025, with relative literature identified through topic-specific searches related to childhood blindness, visual impairment, vision loss, special education, literacy, braille, low vision, assistive technology, psychosocial development, school participation, and cerebral visual impairment. Systematic reviews, meta-analyses, clinical reports, and influential observational or qualitative studies that addressed children and adolescents directly or had immediate relevance for educational planning in pediatric populations were prioritized.

The final selection was intentionally balanced across five domains:

1)early intervention and family processes;

2)psychosocial development and lived experiences;

3)literacy and academic functioning;

4)assistive technology and low-vision rehabilitation; and

5)school participation, including cerebral visual impairment and teacher preparedness.

Given the heterogeneity of the evidence base, our review synthesized findings narratively rather than quantitatively. This review also prioritizes practical educational implications.

Results

The first major finding is that early intervention must be viewed as foundational and not optional. A developmental framework has been proposed specifically for children with visual impairment, arguing that conventional developmental monitoring underestimates visual dependence in early communication and learning (7). Later reviews support this notion and show that early visual intervention, environmental adaptation, and parent-focused support can significantly improve visual function, developmental outcomes, and quality of interactions with the child (5, 6, 8, 9). The strongest message across these studies is that families need structured support in interaction, joint attention, play, and exploration, as these mechanisms help built school readiness and learning (5-9).

An important second finding is that special education for children with visual impairment needs to address psychosocial and neurodevelopmental consequences in parallel with access to the learning curriculum (10). Children with congenital visual impairment may face difficulties in executive functions and self-regulation (11), while adolescents with visual impairment report more loneliness, lower connectedness with peers, and sometimes lower self-esteem or social confidence, even when emotional functioning resembles that of sighted peers (11, 12). Moreover, qualitative studies show that childhood-onset visual disability affects identity, autonomy, participation, and lead to stigma and increased dependence (13, 14). Therefore, it is important that special education must include relational and emotional support, and not only accommodations for learning and classroom access.

A third finding concerns literacy, reading, and academic attainment; visual impairment affects reading speed, the ability to access written materials, reading stamina, and literacy development, even when comprehension is relatively preserved (15, 16). A recent systematic review found that students with vision impairment tend to underperform mainly in reading performance rather than in learning potential, which suggests that access barriers, format, speed, and fatigue are key mediators of school achievement (15). Evidence also indicates that early detection of visual impairment is associated with better academic functioning, while spectacle correction for uncorrected refractive error may improve not only visual access but also academic performance and psychological well-being (17, 18). Thus, where indicated, special education must include early learning-media decisions, high-quality braille teaching, large-print or optical supports, and flexible instructional pacing (15, 17, 18).

Braille remains the backbone of learning for children with visual impairment; however, the literature shows that technology for braille education is still in development.

Another recent systematic review found limited high-quality evidence for current braille-learning technologies, even though these tools show promise in feedback, motivation, and independent practice (19). Prototype work such as BrailleBunny suggests that child-centered design may lead to improved braille learning (20), but stronger comparative studies and implementation evidence are currently needed. It is thus important that technology-based solutions complement explicit literacy instruction by qualified special education professionals (19).

Assistive technology is consistently recognized as educationally valuable, although its availability remains uneven. Studies conducted in school settings show that students use braille books and slates, screen readers, canes, audio devices, tactile tools, and electronic magnifiers for a wide range of academic tasks. Awareness and utilization are substantially greater for traditional tactile aids than for advanced digital assistive technologies, such as screen readers, refreshable braille displays, and electronic accessibility systems (21). Teachers in these settings report a need for improved infrastructure and pedagogical support, while students identify limited availability and cost as major barriers (22). Clinical low-vision and vision-rehabilitation literature further emphasizes that educational planning should routinely incorporate functional visual assessment, low-vision aids, assistive technology trials, and integration of literacy media (22, 23).

Cerebral visual impairment (CVI) has emerged as an important issue for special education. Recent pediatric clinical and school-based studies suggest that CVI is common, underdiagnosed, and strongly associated with reading problems, impaired classroom navigation, reduced attention to visually complex material, and worse school participation (24-26). Additional evidence further shows that awareness and management of CVI among school staff is suboptimal can be improved through targeted education (27). As such, many children who appear inattentive, slow, disorganized, or poor readers may in fact need adapted visual environment, simplified visual clutter, explicit layout instructions, and multidisciplinary assessment including CVI-informed educational planning (24, 25).

Finally, we found that school participation represents a core educational outcome for children with visual impairment. Families report that school experience is influenced not only by academic adaptations but also by acceptance, communication, and the school's willingness to understand and adapt to the child's visual needs (28). Similarly, other studies show that social support at school, opportunities for participation, and everyday routines are decisive for students' well-being and sense of identity (28, 29). Moreover, physical education, which is often treated as secondary, can become either a site of marginalization or inclusion depending on equipment adaptation, task design, and teacher expectations (30). Essentially, special education for visual impairment can be successful only when the student is able to engage socially as well as academically.

Discussion

This review suggests that the most defensible model of special education in children blindness and visual impairment is broad and interdisciplinary. It begins with early developmental guidance, progresses with individualized literacy and learning-media decisions, and ultimately extends to psychosocial support, effective school participation, and transition planning (5-9, 13, 14). A purely medical model is too narrow, since diagnosis alone does not effectively describe how a child reads, navigates, communicates, tolerates visual complexity, or participates with peers (2, 24, 31). Conversely, a purely educational model may also be insufficient, as ophthalmic findings, low-vision assessment, refractive correction, rehabilitation technologies, and diagnoses such as CVI meaningfully shape educational access and thus management strategies (17, 25-27).

Regarding practice, several conclusions can be drawn. Firstly, every child with significant visual impairment should be considered for structured early intervention and family-centered developmental support (5-9). Secondly, schools should make explicit decisions about literacy access, and be able to provide print, enlarged print, braille, tactile graphics, audio support, and digital accessibility tools, which should be used to aid functional vision (15, 19-21). Thirdly, assistive technology should be adequately funded and taught systematically, as the literature shows that underutilization often reflects poor access and weak training rather than lack of need (21). Moreover, psychosocial support must be built into educational planning, especially for adolescents, when friendship patterns, autonomy, and self-esteem become central (10, 14). Finally, teacher education should be improved, particularly in relation to CVI, inclusive classroom design, and participation in subjects such as physical education and group work (24-26, 29, 30).

The evidence base has specific limitations. Reviews repeatedly note limited interventional research, small study samples, heterogenous outcome measures, and insufficient longitudinal follow-up, especially regarding literacy technologies and school-based educational interventions (5, 15, 19). Several influential studies in this field are qualitative or observational, which is useful for describing lived experience and participation but inherently limits causal inference (13, 14, 28-30). An important research gap currently exists regarding rapid adaptation of educational systems to the growing

recognition of CVI, where awareness is improving faster

than service models are being redesigned (24-27). Nonetheless, across different methods and settings, the direction of evidence is consistent and shows that children with blindness or visual impairment benefit from individualized, proactive, family-linked, and participation-oriented special education.

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