

Vision for Learning (Part I): A tool for educators to assist in the detection and treatment of vision difficulties

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The Optometrists Association of Australia (OAA, 2013) advocates that good vision is important for a child's educational, physical and social development. However, according to the Australian Institute of Health and Welfare (2008, p. 8), "along with allergies and asthma, eye disorders are the most common long-term health problems experienced by children". Furthermore, the Children's Vision Campaign estimates that approximately 1 in 4 Australian children suffer from undetected vision problems (OAA, 2013).

Primary teachers encounter many students with various difficulties that have impacted on their learning to varying degrees. This document was created to provide educators with an overview of basic vision difficulties and treatment options. However, it is vitally important to recognise that only a trained practitioner can properly diagnose and treat vision problems.

"There are three interrelated areas of visual function: (1) *visual pathway integrity*, including visual acuity (clarity of sight) and refractive status; (2) *visual efficiency*, including accommodation (focussing), binocular vision (eye teaming) and eye movement control (tracking); and (3) *visual information processing*, including spatial awareness, identification and discrimination, and integration with other senses" (Australasian College of Behavioural Optometrists [ACBO], 2013a).

While it is widely recognised that development can vary significantly from child to child, it is not often recognised that vision also develops (Kelly, 2012, a; 2012b). Vision is in fact our most dynamic sense (ACBO, 2013a). Describing infant vision, the

American Optometric Association (AOA), comments that infants *learn to see* over time: "learning to focus their eyes, move them accurately, and to use them together as a team; and learning to use the visual information transmitted from the eye to the brain in order to interpret, understand and interact appropriately with the surrounding environment" (para 1). Thus, while it was once thought that visual ability was simply inherited, it is now recognised that visual development is largely experience dependent – guiding the plasticity of the developing brain, particularly in those vital years of infancy (Kasamatsu, 2013; Norcia, 2013).

Neuro Developmental Optometry is described in enthusiastic terms by the ACBO (2013b). What is already widely known, in relation to the development of the brain, is that nature opens certain windows for experience to have the greatest effect – optimising developmental opportunities in vision and all other areas (Gabbard & Rodrigues, 2011). Lack of appropriate experience at that time may limit the brain's development to its full potential. However, it is important to recognise that while these windows narrow, they do not shut, meaning that learning is always possible (Gabbard & Rodrigues, 2011). In relation to best utilising these windows of opportunity, the ACBO (2013c) suggests a range of developmentally appropriate activities for helping to develop children's vision abilities, useful for educators and especially parents.

While vision development has some degree of flexibility due to the *plasticity* of the brain, it is also reliant on the sufficient maturity of the nerve cells and of the total physiology of the individual (Hamer, 1990). For this reason, there is a great potential for premature birth to adversely impact on vision

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development (Davidson & Quinn, 2011, p. 337). Also, an important implication for educators and parents is that children must be developmentally ready when commencing formal education.

Rich brains are the product of rich environments; the ‘richness’ of which is largely determined by both the *quality and quantity* of movement activity (Gabbard & Rodrigues, 2011). The ACBO (2013b) emphasises the importance of adequate physical interaction with the environment in developing vision, stating that “vision is motor”. “Individuals are spending much more time concentrating at near distance in sustained ways over extended periods of time which is especially true in the younger generations, and raises serious concerns for the developing eyes and visual systems” (ACBO, 2013d, p.2). The excessive *screen time* that is characteristic of modern society results in many missed opportunities for healthy *real-world (3-D)* experiences, hindering visual development through providing unusually high visual attention grabbing stimulus on a two dimensional screen, without supportive interaction (Peachy, 2013, p. 4). The term *Computer Vision Syndrome* has even been coined to describe the effects of spending excessive amounts of time viewing digital screens, particularly since the development of social media sites such as *Facebook* (ACBO, 2013d). And though excessive computer time may not be the cause of vision problems in all cases, extended periods spent focussing on a computer screen can certainly highlight difficulties where they are present (ACBO, 2013d, para. 8).

In addition to developmental causes, vision problems may be caused by “deficiencies in the physical structures that provide sensory information” (ACBO, 2013b, para. 6) such as *the eyes* and other components of the *visual pathway*. Also, “vision problems and symptoms are among the most common difficulties associated with *acquired brain injuries*” (ACBO, 2013e, para. 1). “Since vision systems are in many parts of the brain, it is possible for any insult to the brain to lead to significant effects on a person’s ability to read, drive, walk and work” (ACBO, 2013e, para. 2). Although such difficulties may be present, there may not be any medical evidence such as in images from *Magnetic Image Resonance (MRI) Scanners* (ACBO, 2013e, para. 17).

Due to the interconnectedness of the visual system with many other systems, “eye and vision problems can cause developmental delays” (*American Optometric Association*, 2013, para. 4). Therefore, developmental problems in relation to vision can have far reaching consequences, and will likely require a multi-disciplinary treatment approach (ACBO, 2013a, para. 2).

Behavioural optometry

Whether it is simply for a routine assessment or to determine the exact nature of a problem where signs of difficulty are detected, visual assessment should be conducted by a *behavioural optometrist*.

In order to encourage the development of vision, behavioural optometrists create and prescribe complex visual programs designed to eliminate visual problems and enhance visual performance (ACBO, 2013f, para. 34). These programs utilise a *holistic* approach which incorporates physical, neurological and developmental aspects of vision (ACBO, 2013f, para. 33). Therefore, behavioural optometrists will carry out a physical examination to evaluate a child’s medical and neurological circumstances and history, and also conduct a complete psychological, emotional and behavioural evaluation (Handler & Fierson, 2011, pp. 833, 829).

The goals for Behavioural Optometrists include: prevention of the development of vision and eye problems; “provision of remediation and rehabilitation for vision or eye problems that have already developed; and development and enhancement of visual skills needed to achieve more effective visual performance” (ACBO, 2013b, para. 21). Clearly, the *Snellen Chart* (eye chart) used in routine eye exams is not sufficient in adequately assessing total visual performance.

For many children, vision difficulties may not become apparent until they enter school. According to the ACBO (2013g), this is due to the fact that spending extended periods of time concentrating at near distance in a sustained manner often highlights any visual deficits that are present – as opposed to actually causing difficulties to manifest. The ACBO (2013g) reports that “behavioural optometrists often find that most children with learning-related vision problems have good eyesight, but have great difficulty conducting close-up vision activities such as reading and writing” (para. 14).

Vision related problems that educators should be aware of include: difficulty with alignment and binocularity (eye teaming skills); strabismus (crossed or wandering eyes); amblyopia (lazy eye); difficulty with oculomotility (eye tracking skills); difficulty with accommodation (focusing); and difficulty with visual perceptual processing. In addition, one area that seems to be somewhat overlooked, but is extremely important nonetheless, is vision problems related to behavioural stress and anxiety difficulties.

It is also important to note, that a high number of children suffer from *colour vision deficiency* (CVD). Statistically, there will be at least one colour blind child in every classroom, with the proportion being much higher in all-boys schools (Colour Blind Awareness, 2013, para. 6).

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Treatment

“Developmental optometrists divide vision therapy into 2 broad categories: *classic orthoptic techniques and behavioural or perceptual vision therapy*” (Handler & Fierson, 2011, p. 843). In addition, effective treatment also requires optometrist to work collaboratively with “other professional disciplines, taking a multidisciplinary approach to evaluating an individual’s displayed difficulties” (ACBO, 2013a, para. 2).

Orthoptic treatment

Orthoptic techniques include the use of lenses (single vision, bifocals, multifocals, tints, prisms and occlusive), as well as surgery to modify the sensory input from eyesight (ACBO, 2013b, para. 14). These are vital tools in treating eyesight problems; however, in the treatment of vision problems they are not sufficient on their own. Vision problems also require vision therapy (Heiting, 2013, para. 5).

For the treatment of some conditions the debate about whether vision treatment should involve orthoptic treatment or vision therapy is quite heated. For example, the two different approaches to the treatment of strabismus are surgery and therapy (CVIN, 2013, para. 6). While surgery is often recommended by optometrists not trained in vision therapy, vision therapy has been demonstrated to achieve higher success rates in correcting strabismus (CVIN, 2013, para. 16). Behavioural optometrists believe that this is because vision therapy addresses the real cause – failure of the brain to achieve binocularity of the eyes (CVIN, 2013, para. 16). In fact, in some cases surgery has even been found to cause scar tissue to develop, only to compound the problem further, and cause later non-surgical interventions to be more difficult (CVIN, 2013, para. 11).

From an educator’s perspective, the most important consideration pertaining to orthoptic treatment is to ensure compliance with any treatment provided. For example, if a child must wear glasses for certain activities, it is important that teachers ensure that they do so.

Behavioural and perceptual vision therapy

“Behavioural and perceptual vision therapy (behavioural vision therapy) is an optometrist-supervised, non-surgical and customised program of visual activities designed to correct certain vision problems and/or improve visual skills” (Heiting, 2013, para 3). “Unlike orthoptic treatments such as eyeglasses and contact lenses, which simply compensate for vision problems, or eye surgery that alters the anatomy of the eye or surrounding muscles, vision therapy aims to teach the visual

system to correct itself” (para. 5). Thus, “vision therapy is like *physical therapy* for the visual system, including the eyes and the parts of the brain that control vision, visual perception and other vision-related functions” (paras. 6, 8). “By treating the entire visual system, vision therapy aims to change *reflexive* (automatic) behaviours to produce a lasting cure” (para. 14). One means of developing automaticity is to ensure that individuals “come to understand and use visual information more effectively – to approach vision *metacognitively*. For example, advice may be given on how to adapt the environment and alter work habits to reduce the load on the visual system” (ACBO, 2013g, para. 10) and of course, the most obvious means of developing automaticity is rehearsal (practice).

As mentioned previously, vision therapy is part of a multi-disciplinary approach, aimed at improving the child’s overall capacity for learning (Heiting, 2013, para. 39). “Referral to another professional may be an adjunctive or even the sole outcome of the optometric evaluation” (ACBO, 2013a, para. 18).

In addition to taking a multi-disciplinary approach, therapy should also take a multi-sensory approach. For this reason, while computer-based programs may be somewhat effective in treating vision problems, they are limited in that they do not allow for integration of body movements into training programs (ACBO, 2013b, para. 11). It is important to remember that *engaging* in real-world (3-D) experiences is still the most effective means of developing vision, and that vision requires movement. This is a fact that is important for educators to remember – especially since they often require their students to sit for extended periods of time while engaging in complex near-vision tasks. Interspersing such activity with physical activities, such as engaging in both indoor and outdoor movement games is important for the developing visual system. *Appendix A (available in Part 2)* provides a link to information on *Brain Gym* – a physical movement program that teachers may find useful in integrating movement activities into their classroom.

Whether educators are engaged in referring students to vision therapy, or in fact assist with part of a child’s vision therapy, it is important that they have some idea about the success and limitations of such therapy. Therapy outcomes are largely dependent on the nature and extent of vision difficulties (Heiting, 2013, para. 24). Also, in some cases “vision therapy may be hindered by memory and cognitive deficits, as well as physical health setbacks” (Ciuffreda, et al., 2008, p. 22). What is clear is that “the earlier the problem is addressed

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the better the long-term results usually are” (ACBO, 2013a, para. 19). However, research findings do suggest “considerable visual system plasticity in response to targeted vision rehabilitation” (Ciuffreda, et al., 2008, p. 21); therefore, it should never be considered *too* late to start vision therapy.

Educators should also be aware that at times eye doctors might recommend eye exercises at home, but it is important to note that research indicates that the improvement outcomes of those performing home-based exercises is much lower than those engaged in office-based vision therapy in combination with home exercises; with one study finding success rates of 43% and 73% respectively (Heiting, 2013, para. 32). If such a program does fail to produce gains, teachers must provide feedback to parents and perhaps optometrists.

Thus, some implications of vision therapy for teachers are: that teachers must assist students who require vision therapy to engage in every aspect of their vision therapy as it is relevant in the school setting; and to work collaboratively with parents and other professionals, providing regular feedback on therapy outcomes, as well as ongoing visual difficulty. Most importantly, teachers should treat every student as though they require vision therapy; engaging students in *movement activities* that promote the development of vision, and ensuring that students develop *good vision habits*.

Good vision habits

There are a number of ‘good vision habits’ that individuals can adopt in order to ensure maximum visual efficiency. These habits are useful for both educators and parents, and are based around the following recommendations by vision experts:

- **“Take a break every 20 minutes** when reading, studying or completing close work. Look up, focus on other objects around you, close your eyes and roll them widely a few times, before resuming work” (ACBO, 2013f, para. 12).
- **“Work distance is important:** don’t hold your book or work too close. Knuckle to elbow distance between your eyes and the book is ideal” (ACBO, 2013f, para. 13).
- **“Good lighting:** ensure that your work is adequately lit. Room lighting is adequate so long as it also illuminates the reading matter” (ACBO, 2013f, para. 14). Glare and reflection should be minimised (OAA, 2013e, p. 4).
- **Good posture:** don’t read whilst in bed or reclining. Remember to keep text at an appropriate distance, and also to use both eyes equally (ACBO, 2013f, para. 15).

- **“Angle of work surface:** slope-topped desks are recommended due to the fact that they encourage a balanced body posture” (ACBO, 2013f, para. 16).
- **“Watching Television:** don’t sit closer than you have to, and ensure that the room is well lit” (ACBO, 2013f, para. 17). Limit the amount of time that is spent watching television to sessions of no more than two hours (OAA, 2013e, p. 4). Federal Government guidelines actually recommend that for developmental reasons children under the age of two should not watch television at all (Australian Government Department of Health and Aging, 2009, p. 2).
- **“Alternate close work with activities:** intensive use of eyes, such as when studying should be alternated with a period of activities that require distance vision, such as outdoor play and sport” (ACBO, 2013f, para. 18).
- **“Don’t overdo it when you’re sick, tired or stressed:** your body’s energy reserves are lowered and visual skills will be reduced” (Handler & Fiererson, 2011, p. 832; Rahman, et al., 2013, p. 1). High fever can damage the visual system (ACBO, 2013f, para. 19).
- **“Don’t read in the car:** the movement of the vehicle places excessive strain on your eyes when focusing and teaming” (ACBO, 2013f, para. 20).
- **“Good writing grip:** should be between the thumb and the next two fingers, and allow you to see the tip of the pencil when writing. You should also ensure that work angle and posture are correct” (ACBO, 2013f, para. 21).
- **“Glasses:** ensure that you understand their purpose – for near or far vision, or constant wear. Make sure they are kept clean, well-adjusted and work straight on the face” (ACBO, 2013f, para. 22).
- **Read aloud to children (particularly when they are younger):** in order to assist them to develop strong visualisation skills as they learn to ‘picture’ the story in their minds (CVIN, 2013b, para. 7). When children are read aloud to, they are assisted in developing language skills that may be helpful in overcoming any vision problems that are present (Handler & Fiererson, 2011, p. 848). Handler & Fiererson (2011) inform that “educational experts indicate that reading aloud to children is the single most important activity for parents and caregivers to do to prepare children to learn to read” (p. 824).
- **Avoid ultraviolet (UV) damage:** use sensible sun protection measures such as sunglasses

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and a hat, to reduce the harmful effects of the sun's rays, particularly between the hours of 10 a.m. and 3 p.m. (OAA, 2013e, p. 4).

- **Eat a nutritious diet:** adequate and appropriate food and water intake is essential for superior functioning of the visual system (Hong & Press, 2009, para. 2). Natural food high in antioxidants is important (OAA, 2013e, p. 4).
- **Be aware of normal developmental milestones:** educators, and particularly parents, must be aware of normal developmental milestones that children progress through. This will not only allow identification of signs of eye and vision problems, but also assist in ensuring that children engage in age-appropriate activities (AOA, 2013, para. 6). The *Children's Vision Information Network* (Learning to See - How Vision Develops, 2013) provides a useful overview of vision development. It is also important to note that developmental milestones may be reached 'too early'. For example, the *American Optometric Association* (AOA), warns that evidence suggests that "early walkers who engage in minimal crawling may not learn to use their eyes together as well as babies who crawl a lot" (AOA, 2013, para. 16).
- **Ensure that children have regular eye examinations:** in order to monitor visual development regular visual assessments are recommended. The *Australasian College of Behavioural Optometrists* (ACBO), recommends that children undergo visual assessment at the following times: "6 months of age; 3.5 years of age; during the first year of school; during the third year of school; in the final year of primary school; and in the last year or two of high school. This covers the major times in early life when the eyes change or when the visual demands in the individual changes" (ACBO, 2013a, para. 16).

This list is not intended to be exhaustive; however, it should provide a justified practical starting point for ensuring that vision difficulties are prevented or minimised.

Summary

Clearly, the issue of adequate visual functioning is of increasing concern in our modern society, and therefore an area of growing importance for educators due to the adverse effect it is having on children's learning. For many, the problem begins with the erroneous assumption that *vision* and

eyesight are synonymous; while good *visual acuity* and *healthy eyes* are important, the *process* of engaging in vision must not be ignored. Educators must be aware of how they can assist students to *develop* their vision to its fullest potential. They must also have an adequate understanding of *vision problems* and the signs and symptoms of these. This will help to ensure that timely *diagnosis* and *treatment* is undertaken. In fact, it is useful for educators to be able to carry out simple *preliminary assessments*, especially in situations where providing parents with solid evidence of concerns is required. Additionally, educators must have a basic understanding of *treatment options* such as *orthoptic treatment* and *behavioural and perceptual therapy*. They must ensure that every step is taken to ensure that treatment programs are followed. Also, it is important that educators work *collaboratively* with parents, optometrists and other professionals to ensure the best outcomes possible for their students. Most importantly, educators must ensure that all students develop *good vision habits*, and engage in frequent and varied *movement activities* that will allow students to develop their visual system to its fullest potential. **TEACH**

“The problem begins with the erroneous assumption that vision and eyesight are synonymous”

Vision for Learning (Part II) will cover: colour blindness, resources, assessment and evaluation templates.

References

- American Optometric Association. (2013). *Infant Vision: Birth to 24 Months of Age*. Retrieved from American Optometric Association: <http://www.aoa.org/s9420.xml/prt>
- Australasian College of Behavioural Optometrists. (2013a). *Vision and Learning*. Retrieved from Australasian College of Behavioural Optometrists: <http://www.acbo.org.au/news-views/for-patients/103>
- Australasian College of Behavioural Optometrists. (2013b). *Patient Information - Behavioural Optometry*. Retrieved from Australasian College of Behavioural Optometrists: <http://www.acbo.org.au/news-views/for-patients/249-patient-information-behavioural-optometry>
- Australasian College of Behavioural Optometrists. (2013c). *Patient Information - Toys & Games*. Retrieved from Australasian College of Behavioural Optometrists: <http://www.acbo.org.au/news-views/for-patients/255-patient-information-toys-a-games>
- Australasian College of Behavioural Optometrists. (2013d). *Patient Information - Computer Vision Syndrome*. Retrieved from Australasian College of Behavioural Optometrists: <http://www.acbo.org.au/news-views/for-patients/270-patient-information-computer-vision-syndrome>
- Australasian College of Behavioural Optometrists. (2013e). *Optometric Care of Acquired Brain Injuries*. Retrieved from Australasian College of Behavioural Optometrists: <http://www.acbo.org.au/news-views/for-patients/105-optometric-care-of-acquired-brain-injuries>
- Australasian College of Behavioural Optometrists. (2013f). *Patient Information - Improve Your Vision*. Retrieved from Australasian College of Behavioural Optometrists: <http://www.acbo.org.au/news-views/for-patients/252-patient-information-improve-your-vision>

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- Australasian College of Behavioural Optometrists. (2013g). *Patient Information - Learning Related Vision Problems*. Retrieved from Australasian College of Behavioural Optometrists: <http://www.acbo.org.au/news-views/for-patients/253-patient-information-learning-related-vision-problem>
- Australian Government Department of Health and Aging (2009). *Get up and grow guidelines*. <http://www.health.gov.au/internet/main/publishing.nsf>
- Australian Institute of Health and Welfare. (2008). *Eye Health Among Children*. Retrieved from Australasian Institute of Health and Welfare: <http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=6442459900>
- Children's Vision Information Network. (2013). *Strabismus: Crossed or Wandering Eyes*. Retrieved from Children's Vision Information Network: <http://www.childrensvision.com/strabismus.htm>
- Ciuffreda, K. J., Rutner, D., Kapoor, N., Suchoff, I. B., Craig, S., & Han, M. (2008). Vision Therapy for oculomotor dysfunctions in acquired brain injury: A retrospective analysis. *Optometry*, 18-22.
- Colour Blind Awareness. (2013). *Teachers*. Retrieved from Colour Blind Awareness: <http://www.colourblindawareness.org/teachers/>
- Davidson, S., & Quinn, G. E. (2011). The Impact of Pediatric Vision Disorders in Adulthood. *Pediatrics*, 334-339.
- Gabbard, C., & Rodrigues, L. (2011). *Optimizing Early Brain and Motor Development Through Movement*. Retrieved from Earlychildhood NEWS: http://www.earlychildhoodnews.com/earlychildhood/article_view.aspx?ArticleID=360
- Hamer, R. D. (1990). *What Can My Baby See?* Retrieved from The Smith-Kettlewell Eye Research Institute: [www.ski.org/Vision/](http://www.ski.org/Vision/babyvision.html)
- Handler, S. M., & Fierston, W. M. (2011). Joint Technical Report - Learning Disabilities, Dyslexia and Vision. *Pediatrics*, 818-856.
- Heiting, G. (2013). *Vision Therapy for Children*. Retrieved from Vision Therapy for Children: When Glasses Aren't Enough: http://www.allaboutvision.com/parents/vision_therapy.htm
- Kasamatsu, T. (2013). *Model Visual Cortex*. Retrieved from The Smith-Kettlewell Eye Research Institute: <http://www.ski.org/Vision/Scientists/kasamatsu.html>
- Kelly, D. (2012a). *Vision & Seeing*. [Video Lecture]. Brisbane: Roberts Alexander Optometrists.
- Kelly, D. (2012b). *What is Vision Development*. Retrieved from Roberts Alexander Optometrists at <http://www.robertsalexander.com.au/About-Optometry/Vision-Development.aspx>
- Norcia, A. M. (2013). *Visual Development*. Retrieved from The Smith-Kettlewell Eye Research Institute: <http://www.ski.org/Vision/Scientists/norcia.html>
- Optometrists Association of Australia. (2013). *A Parent's Guide to Good Vision*. Retrieved from Optometrists Association of Australia: <http://www.optometrists.asn.au/LinkClick.aspx?fileticket=%2fmqj0K%2fc04k%3d&tabid=845&language=en-AU>
- Peachy, P. (2013). *Help your child to develop to their Functional Vision potential*. Retrieved from Australasian College of Behavioural Optometrists: <http://www.acbo.org.au/news-views/for-patients/124-help-your-children>
- Rahman, A., Languille, S., Lambert, Y., Babiloni, C., Perret, M., Bordet, R., Aujard, F. (2013). SI Deprivation Impairs Spatial Retrieval but Not Spatial Learning in the Non-Human Primate Grey House Lemur. *PLOS ONE*, 1-7.