

Generation Z and Generation Alpha and the Visual System

By Jannie Ferreira



Generation Z and Generation Alpha spending time together

Demographers and researchers have been using the term 'Generation' at various times throughout history to describe alienated youth as belonging to a specific cohort born over a specific period ^[1]. This became common practice after World War II and we saw the Baby Boomers followed by Generation X [born between 1965 and 1979] and Generation Y [born between 1980 and 1995].

It is believed that each generation has common characteristics that give it a specific character. This approach is very popular in the world of business where companies are using it to try and predict preferences and spending patterns. The characteristics are mostly determined by socio-economic and political influences, but since the 1990's the impact of technology has become the overriding factor.

This coincided with the introduction of a new generation, called generation Z. They are also known as "digital natives" because they are extremely comfortable with technology and have experienced more advancements in technology than all previous generations put together. From an optometric perspective it is important to understand how this may impact on visual requirements and on vision in general.

Technological advances 1997 to 2014

- 1997: Google.com is registered as a domain
- 1998: Portable MP3 players enter the market
- 2000: USB flash drives become available, Nokia 3310 launched
- 2001: Wikipedia is launched
- 2003: My Space is launched
- 2005: YouTube is launched

- 2006: Facebook opens to the public
- 2006: Twitter is launched
- 2007: Dropbox is founded
- 2007: First iPhone is released
- 2009: Whats App is founded
- 2010: iPad is launched
- 2010: Instagram is launched
- 2012: Facebook has 1 billion active users
- 2014: Google Glass is launched

According to McCrindle ^[2], Generation Z is the most formally educated generation in history and more of them will be university educated. We have just experienced it in South Africa where the demand for tertiary education exceeds the capacity and funds to provide it. You may be amazed to know that this also happens elsewhere. A 2013 survey by Ameritrade found that 47% of Generation Z in the United States were concerned about student debt, while 36% were worried about being able to afford a college education at all ^[3]. This generation is faced with a growing income gap and a shrinking middle-class, both of which have led to increasing stress levels in families ^[4]. This increased focus on formal education is unsurprisingly linked to more time spent behind screens and on digital devices. They are living largely indoors and prefer a sedentary lifestyle to an active carefree childhood. Based on current trends it is predicted that 77.9% of males and 61.2% of females will be overweight or obese by the time they reach adulthood ^[2].

This Internet- savvy and technologically literate generation has been shaped to multitask to the extent that it amazes the older generations. They move quickly from one task to another and often place more value on speed than accuracy. They can sit at home and with their wireless, hyperlinked world they can access any information within seconds ^[3]. This has changed the world of education forever, but sadly in many countries across the globe educational systems are not ready to or capable of making this paradigm shift. According to Katherine Prince, "schools may have delivered in the past, but they're certainly not working for today, they were established in a different age and for a different set of purposes" ^[5].

Generation Z college students prefer intrapersonal and independent learning over group work yet like to do their individual work alongside others when studying ^[6]. They like their learning to be practical and hands-on and want their professors to help them engage with and apply the content rather than simply share what they could otherwise find on their own online ^[6]. Generation Z requires a total rethink of

educational systems and curriculums will have to be revised completely.

While researchers and parents agree on the need for a change in the educational paradigm the kinds of innovations have sparked a heated debate. On the one hand, technology and hand-held devices offer the potential for deeper involvement in learning ^[7] and more individualised instruction, thereby making this generation potentially better educated and more well-rounded. On the other hand, some researchers and parents are concerned that the prevalence of these devices may cause technology dependence and a lack of self-regulation that may hinder child development ^[8].

I have had the privilege of attending a number of international conferences and since the Commonwealth Games Conference in Manchester in 2002 a theme that became central to all these conferences was the concept of Physical Literacy. At the ICSEMIS Pre-Olympic Conferences in Guangzhou in China in 2008 and the one in Glasgow, prior to the London Olympic Games in 2012 researchers expressed a deep concern regarding the lack of proper physical development in Generation Z. This was also linked to a lack of sensory development resulting in children presenting with severe constraints and behavioural disorders. If you study the literature on sensory development, you will find that it is crucial to brain development – it helps to build nerve connections in the brain's pathways.

The interaction between information and the sensory receptors (the eyes, ears, tongue, nostrils, hands) promotes dual processing of the brain, which means the integrated use of both hemispheres of the brain which research shows is imperative to learning. Lacking in sensory development will impact on the child's ability to participate in classroom activities and affects academic achievements. It is great to see that organisations such as Mindmoves embarked on a programme called "Baby Gym" to emphasise the importance of sensory development.

Physical Literacy is a fundamental and valuable capability that can be described as a mastering of fundamental movement skills that permit children to read their environment and make appropriate decisions, allowing them to move confidently and with control in a wide range of physical activity situations ^[9]. It supports brain and language development and it is therefore not surprising to see more and more researchers warning against overexposure and uncontrolled exposure to hand-held devices. This opens the door for sports vision to move towards general visual skills development associated with fine motor skills development. In a previous article evidence was presented for a condition called Acute Acquired Comitant Esotropia resulting from overexposure to hand-held devices before proper fine motor development and visual skills are in place ^[10]. In May 2014, presenting at an International Play Conference, I stressed the need for young children to spend most of their day playing. I used a simple example to explain sensory development and the integration with visual processing skills.



This ball with which the child needs to match different shapes and forms was a common toy in many households. It requires visual perceptual skills and touch and feel. The young child may even put pieces in her/his mouth to try and taste them and can also shake the ball involving hearing. It is also a ball that can be rolled, kicked or thrown around, and is therefore an excellent toy to integrate several senses and assist in general brain and movement development. In Generation Z this has now been replaced by a picture on a screen where the child use one finger to drag the shape to its appropriate hole. The difference in sensory development should be obvious.

The ability to integrate the visual processing skills with fine motor movement such as is required for writing or catching a ball is lost in this process. Furthermore, with the ball visual stimulation results in expanding spatial knowledge and develops muscular strength and coordination which is also lost staring at a screen. This presentation has been widely reported on and I have received numerous reports on how this impacted on activities in several playgroups and pre-school settings. I believe optometrists have a major role to play in guiding parents and may even develop a whole new meaning to the concept of visual exercises.

While researchers, educationalists, parents and analysts are still hard at work to find solutions for the challenges associated with Generation Z, a new generation has entered the scene. The launch of the iPad in 2010 coincided with the beginning of the next generation called Generation Alpha ^[2]. The term "alpha" indicates a whole new beginning and in a sense, sends a stern warning that we are now entering a whole new order that will have profound implications for the basic mechanisms of modern life worldwide ^[11]. According to social researcher Mark McCrindle ^[12] there are now 2.5 million members of Generation Alpha being born around the world each week. Eventually they will number almost two billion. They are born into a fully-fledged information technology world that will mediate everyday life and demands via a digital device. A world where in 2010, when they were

first born, the word of the year was “app”, a world where 100 hours of videos get uploaded on YouTube every minute of the day. Add to this the rise in Instagram, where life is photographed and shared instantly on a global platform. The major significance of this is that Generation Alpha are more reliant and influenced by visual information and much less exposed to or interested in written and verbal interactions and communications. McCrindle ^[12] calls it a world of Screenagers where not only do they multi-screen and multi-task, but where glass has become the new medium for content dissemination and unlike the medium of paper, it is a kinaesthetic, visual, interactive, connective and portable format.

This generation will hardly ever put hand to paper to write and even text mail will have to make way for voice mail. Words are being replaced by pictures in sending or receiving messages or information. This will have a profound effect on every aspect of life and that includes vision and vision related skills. Even reading will come under siege. They will sit back and by the press of a button someone else will do the reading for them. As early as 2003 Adobe Systems commissioned Bamford ^[13] to develop a “science” called Visual Literacy. It refers to the skills required to interpret communication that happens through the use of signs, symbols, gestures and objects. Even older generations have joined this revolution and now frequently use these visual images in electronic communications. A wise man once said a picture paints a thousand words. Yes, not only does it carry a message, but it can also evoke a feeling or a mood and for this reason social scientists have embarked on several studies to investigate the impact of this on the values, attitudes, behaviour and motivation in children ^[14].

The inability of most educational systems across the globe to keep up with the rapidly changing environment that calls for innovative, creative and flexible learning systems is creating serious conflict with older generations. Christensen ^[15], a professor at Harvard Business School states that current students are thinking and learning very differently to past generations, but we still place them in schools based on a system for people of foregone eras that compels teachers to teach many learners in the same way and at the same pace. The result of this is that many learners are not learning or learning in a very inefficient way.

I strongly believe that we respond to children who do not fit into this system by labelling them as being attention deficient and thinking the solution is to put them on medication. Girls tend to become more emotional and depressed and Josephine Kim ^[16] from Harvard Graduate School of Education warns against the ever increasing depression amongst young people. In a survey that I have done under 45 educational psychologists and therapists in 2017 I was astonished to find that from their client base one out of 10 girls under the age of 10 years was taking anti-anxiety or anti-depressant medication [Ferreira unpublished results].

All around South Africa there is a major increase in the number of private schools as well as an increasing number

of parents who prefer to home-school their children. In an informal survey I have done I found that one of the main reasons why parents prefer these options is that children with average and more so above average intelligence are not performing in the government system and are indeed being labelled as having attention deficits. In private schools with smaller classes and a more individualistic approach these children are thriving. In studying Maxine Driscoll’s “Think Strategic” White Paper ^[17] on the challenges facing education it is obvious that the solution does not only revolve around adding technology to the classroom but to using technology in such a way that it will enhance differentiated self-directed learning to provide for learners’ different ways of learning.

Whatever system is decided on, one thing is for certain and that is the massive demands that will be put on the visual system. According to Conaway a survey done by the American Optometric Association (AOA) in 2009 revealed that parents are deeply concerned that hand-held electronics may damage their children’s eyesight and 53% of parents believe that 3D viewing may be harmful. Several academics such as Hoenig from UC Berkeley and Sheedy from the Department of Optometry at Pacific University were quick to respond and assure parents that there is nothing to fear as long as it is used wisely ^[18]. I am hesitant to agree with these statements because there is some compelling evidence on the possible microwave radiation emitted by these devices that may also harm the visual system. Nevertheless, I believe like with so many other things in life the keyword is “moderation”. It is not hand-held devices as such that may cause problems to the visual system ^[19] but rather the increased time spent on doing “near work”.

It is interesting to note that the AOA in releasing their 2015 American-Eye-Q survey results took a much stronger view on this topic. They stated: “Since technology use is expected to continue to climb, we need to make sure that children and parents are aware of the visual risks associated with staring at screens for long periods of time and take the proper precautions to help alleviate eye and vision problems” ^[20]. Heiting and Wan ^[21] produced statistics showing that by 2009 American children were spending 7.38 hours daily on technological devices and it is common knowledge that it has increased dramatically since then. You may now understand why I found it necessary to introduce you to Generation Z and Generation Alpha. Before dealing with all the visual problems it is necessary that we rethink our role and responsibilities.

Optometrists should move to a far more holistic approach. If these children are lacking in sensory development and physical literacy, most visual interventions will not have the required effect. As primary health care providers it is our responsibility to address these matters as well. It will also be essential to make comprehensive eye exams a priority for all children entering school and encourage regular follow-ups. It may sound impossible within the South African context but if we can get our message to teachers and parents – who knows what may happen!

The effects of technology on vision

The obvious question by now should be: what are the signs and symptoms of digital strain that parents, caregivers, teachers and optometrists must be on the lookout for?

General signs and symptoms associated with the use of handheld devices and computers.

- Headaches
- Eye Strain
- Fatigue
- Burning, Itchy, Watery Eyes
- Loss of Focus
- Blurred Vision (can occur at near or distance)
- Double Vision
- Neck/Shoulder Pain
- Sensitivity to Lights (Photophobia)

I believe that most optometrists are acquainted with the concepts of Visual Fatigue Syndrome (VFS) and Computer Vision Syndrome (CVS) since they have been around for many years ^[22, 23] and the signs and symptoms mentioned in the text box relates to those studies. Most people would accept that this results from staring and focusing on computer screens for extended periods of time. These studies were aimed at assisting people in the work place, but we are now well aware that the big change in the last decade relates to these devices becoming common- place in the lives of children belonging to Generation Z and Generation Alpha. It is not uncommon to find babies playing on Smart phones and seeing companies advertising baby trawlers with a bracket for a tablet.

More researchers are now joining and are warning against the effect of these devices on the developing visual system of young children. Working on video display terminals was shown by several authors ^[24] to induce abnormalities in accommodation and vergence, when compared to ordinary hard copy work. Computer use demands fine motor skills from young eyes that are not well developed. Only when the visual system matures is a child better able to handle the stress of staring at a screen. Spending hours looking at a screen less than 30 cm away causes severe stress on a child's eyes because the computer forces the child's vision system to focus and strain a lot more than any other task. This can put children at an even greater risk than adults for developing more severe symptoms of computer vision syndrome. In a previous publication ^[10] I mentioned a significant increase in conditions such as near work induced transient myopia (NITM) and also acute acquired comitant esotropia (AACE).

In 2016 Lee et al. ^[25] reported on this unusual presentation of esotropia in children using smartphones for more than four hours per day. Keeping the children away from these devices showed an immediate improvement in the esotropia. In my own practice I have seen 10 children between the ages of two and six years over the last six months presenting with AACE related to the excessive use of hand-held devices. Prior to 2010 several researchers were hesitant to link the global increase in myopia to an increase in near point work and hand-held devices, but current evidence makes it very difficult to argue against this. I have no doubt that the major

increase in myopia relates to sustained near work strain on the visual system [Ferreira publication in preparation]. I find it strange that some researchers still believe that myopia is a "genetic disease".

There are also other studies that suggest that a lack of exposure to sunlight could affect the growth and development of the visual system and may cause myopia in today's children spending more time indoors^[26]. I will support this theory if they can keep children indoors and away from hand-held devices and still find an increase in myopia.

There are also studies that suggest electronic devices give off high-energy, short-wavelength, blue and violet light, which may affect vision and even prematurely age the eyes. Early research shows that overexposure to blue light could contribute to eye strain and discomfort and may lead to serious conditions in later life such as age-related macular degeneration (AMD), which can cause blindness^[27]. There is no real hard evidence yet but "blue light coatings" is becoming common practice.

Guidelines for use of electronic devices

In line with a more holistic approach in dealing with visual problems our emphasis should be to prevent rather than cure [or compensate]. In addition to the risk of computer vision syndrome, visual fatigue syndrome, myopia and AACE, we should be aware of the concerns that excessive use of hand-held devices may have on the physical development of the child. Several organisations have now reviewed the current scientific literature about this and published a number of guidelines for parents to help their children attain physical development ^[28]. If we add guidelines to minimise the effect on the visual system ^[29] we can produce quite a comprehensive list of guidelines.

1. Encourage a mix of tasks throughout the day. Children should take frequent breaks from computer use and take part in a variety of activities that involve postural changes and physical movement. Performing sedentary tasks using electronic media (computer use, watching TV, texting, etc.) should be limited to less than two hours per day. [If you add the hours at school that they spend on these devices, it still adds up to 8 hours per day]. To be safe children [and adults] should take a 60-second break every 20 minutes and at least 10 minutes after two hours of staring at a screen. Because dry eyes seem to be the most common symptom, people should be encouraged to blink regularly, especially if they wear contact lenses. Tear supplements will also work wonders but the dry, irritated eye actually serves as a good warning sign that it is time for a break.

2. Encourage the use of proper postures when working at a desktop computer. Workstations should be designed to suit the child's size and enable a range of suitable postures. Feet should be able to rest comfortably on the floor; desk height should be at elbow height; document holders should be used to position paper materials near the computer screen. The screen should be below eye level [20 cm] because it is much more comfortable and less strenuous looking down.

3. Encourage a comfortable working distance i.e. Harman's distance for all hand-held devices and at least 50cm for desk top screens. The closer the screen the more strain there will be on the accommodative and convergence systems resulting in double vision and/or blurred vision. If possible increase the font size and adjust the screen resolution and contrast.

4. Ensure that proper lighting is provided. Distant or frontal light can cause a great deal more glare off screens, which makes focusing even more challenging. If possible, use ambient overhead lighting which provides good results. The screen should also be positioned and angled to avoid glare. And remember to clean your screen once in a while!

5. Teach your child computing skills, including how to touch-type with minimum force and how to use keyboard shortcuts to reduce mouse use.

6. Teach your child to respond appropriately to discomfort during computer use, including taking more frequent breaks and, if symptoms persist, seeking advice from your optometrist.

7. Although the use of "computer glasses" is considered to be ineffective and controversial by some researchers, I have no doubt that they work and that they prevent NITM and even proper myopia. It is when multifocal or low plus lenses are prescribed that the results become questionable. As a rule of thumb – add +1.00 to the distance script to obtain the required power of the lenses.

8. Lastly, we need to guide children to understand the clear boundaries between the virtual world and the real world we live in if we wish to prevent adverse behaviour. The answer is not to label them as ADHD, dyslectic or suffering from depression.

Generation Z and more so Generation Alpha is already demanding a complete rethink on many aspects of our lives and is presenting all professions involved with them with some exciting challenges. Failing to meet these challenges may have severe implications for society as we know it.

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1. Generation Z prefer to:
 - a. Spend most of their time living indoors
 - b. Be more formally educated than any other generation
 - c. Spend most of their time staring at screens and hand-held devices
 - d. None of the above
 - e. All of the above
2. Physical literacy:
 - a. Is a fundamental and valuable capability that can be described as a mastering of fundamental movement
 - b. Has nothing to do with brain development
 - c. Lacking physical literacy will not impact on visual skills
 - d. Is well developed in Generation Z and Generation Alpha
3. Hand-held devices are:
 - a. Good for expanding spatial knowledge
 - b. Assist in the development of muscular strength and coordination
 - c. Support the integration of visual processing skills with fine motor movement
 - d. B and C
 - e. None of the above
4. Generation Alpha:
 - a. Was first born in 2010
 - b. Prefer to work on paper rather than on touch screens
 - c. Communicate with words rather than symbols or pictures
 - d. Don't enjoy multitasking
5. Visual Literacy refers to the skills required to interpret communication that happens through the use of signs, symbols, gestures and objects.
 - a. TRUE
 - b. FALSE
6. Educational systems across the globe:
 - a. Are ready to deal with Generation Alpha
 - b. Encourage differentiated learning
 - c. Are using technology very efficiently
 - d. A and B
 - e. None of the above
7. Generation Alpha will not suffer from Depression and/or ADHD.
 - a. FALSE
 - b. TRUE
8. Visual risks associated with the use of technology include:
 - a. Headaches
 - b. Eye strain
 - c. Blurred vision
 - d. Double vision
 - e. All of the above
9. Staring at a screen for several hours may result in:
 - a. Dry irritated eyes
 - b. Blink rate to increase
 - c. Watery eyes
 - d. A and C
 - e. Only A
10. AACE can be caused by:
 - a. Intra-cranial disease
 - b. Trauma
 - c. Overexposure to hand-held devices
 - d. A and B
 - e. All the above
11. AACE induced by hand-held devices:
 - a. Only in children with significant hyperopia
 - b. May be the result of accommodative and vergence deficiencies
 - c. Only temporary in nature and will restore itself
 - d. A and B
 - e. All of the above
12. Myopia:
 - a. Is only a simple genetic disease
 - b. Can be caused by limited exposure to sunlight
 - c. Can be caused by overexposure to hand-held devices
 - d. All of the above
 - e. B and C
13. It is possible that cell phone radiation may cause damage to the eyes.
 - a. TRUE
 - b. FALSE
14. Guidelines to consider when using technology
 - a. Screen should be at eye level
 - b. Take regular breaks
 - c. Keep screen as far away as possible
 - d. Don't wear contact lenses
 - e. B and C
15. Guidelines to consider when using technology
 - a. Using tear supplements is not a good option
 - b. Frontal lighting should be avoided
 - c. Increase font size if possible
 - d. Keep screen at an angle to avoid glare
 - e. B, C and D
16. It is proven beyond doubt that blue light filters must be used.
 - a. TRUE
 - b. FALSE
17. When prescribing glasses for children to be used on technological devices:
 - a. Multifocal is a good option
 - b. The +0.50 concept still works well
 - c. Consider using prisms
 - d. Should have at least +1.00 added to distance script
18. Young children:
 - a. Should not be allowed to work on these technological devices at all
 - b. Are capable of handling this near point strain with ease
 - c. Should be guided to understand the boundaries between the virtual world and the real world
 - d. B and C
 - e. C
19. There is no need for Generation Alpha to have regular visual examinations.
 - a. TRUE
 - b. FALSE
20. Generation Alpha kids:
 - a. Will be happy and care-free
 - b. Will not put added demands on our educational systems
 - c. Will change our concepts of life for ever
 - d. Will create a whole new standard in global communications
 - e. Only c and d