The Impact of Fluorescent Lighting on Children

An overview

Deb Hopper

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Fluorescent lighting has long been used as the accepted standard for illuminating large indoor areas. It is relatively cheap, long-lasting, and doesn’t overheat or create as much glare as other forms of lighting, such as incandescent bulbs.

However, lighting can have a profound effect on our response to our environment. In our own homes, we often use it to create a certain mood, dimming the light when we want to relax in the evening, decorating the house with coloured lights for a party atmosphere, or just using lamps to enhance the natural light entering a room during the day.

So, it shouldn’t come as a surprise to learn that, just like adults, children in school classrooms react differently to variations in the available light. If they are struggling with any kind of sensory processing issues, such as those with an autism spectrum disorder or ADHD, the effects can be quite significant. And they go well beyond the obvious problems arising from the inability to see clearly, though this is undoubtedly pivotal.
Clearly, the best time to take lighting considerations into account is during the classroom design phase. However, the importance of resolving issues in existing classrooms should not be underestimated or overlooked.

- Insufficient light - not enough light for the task
- Glare - too much light for the task
- Unequal distribution of light in the room
- Flickeringsensory inputs and go into meltdown.

**Insufficient light**

This really speaks for itself. There is a direct correlation between lighting quality and the ability to see clearly, concentrate and perform well in the classroom. [1] It stands to reason, if a child in a classroom can't see well, they are going to be less focused on the task at hand, less engaged, and more likely to drift off and distract other students.

**Glare**

Glare can be either direct – too much light in the field of vision – or indirect – caused by light reflecting off a surface and into the eyes. Indirect glare can be
a major problem in the classroom when using electronic whiteboards, which tend to have shiny surfaces that reflect internal light from around the room. The impact of glare can also be compounded by the colour of the walls, glossy bright colours being the worst offender.

**Distribution**

The physical size and shape of the classroom can lead to an imbalance in the amount of available light that reaches different parts of the room. Overhead lighting can create shadows and glare that make it difficult to see and work in some areas.

**The Flicker Effect**

The big issue with artificial lighting can be summed up in one word – flicker. And ALL electric light sources flicker, mainly because of the use of alternating current (AC) to deliver power to the light. This sets up an on again/off again situation, which has the effect of turning the light on and off at relatively higher speeds than the human eye can detect. Fluorescent lights are particularly notorious for creating the flicker effect when the ballast used to regulate the current inside begins to deteriorate, as they do over time. In this instance, the flicker effect worsens and becomes visible. And we all know how irritating that can be.

The flicker effect, at its most serious, has been shown to cause epileptic seizures in some people. But for those with sensory processing issues, it can also have the effect of making moving objects appear stationary, as in a strobe, and cause other visual disturbances and headaches.
The Effects of Lighting on Children

Prof. Manuel Cabrera Jr. of the University of California, Los Angeles [3], found a range of effects that can negatively impact a child’s classroom experience. The list below highlights just some of the ways in which children can be affected by fluorescent lighting:

- The flicker effect has been linked to eyestrain, fatigue, and a decrease in visual performance. It has also been shown to affect the basic brainwave pattern (EEG) and to decrease work efficiency.

- Narrow spectrum fluorescent lighting can make the classroom environment appear less vibrant and inviting and so negatively impact children’s interactions with both other children and adults.

- Both traditional and compact fluorescent lights contain dangerous levels of mercury, which can cause damage to a child’s brain, liver, and lungs, as well as sensory impairment.

- May worsen the symptoms of pre-existing behavioural disorders in children, possibly increasing repetitive behaviour patterns in autism spectrum disorders.

- Fluorescent lighting can also increase the chances that a child with a sensory disorder will act out and exhibit undesired behaviours in response to being visually overstimulated.[4]
On top of this, children’s academic performance has been shown to be impacted by poor quality lighting in the classroom. A study by staff at Temple University, Philadelphia, reported that “fluorescent lights... have an unnatural colour and a discontinuous spectrum. They have been associated with increased student stress and may negatively affect students’ learning, behaviour and comfort.” [5]

We all prefer different light levels and colours when we are working, and children are no different. The colours projected by classroom lighting can impact a child’s concentration and engagement when working on classroom activities.
A 2016 study by a Korean research team concluded that lighting could be optimised for different activities, including quiet reading, teacher-led activities, and even recess times. Despite their young ages, the children involved in the study were aware that they worked better under different lighting conditions, depending on the task they were completing. The academic results backed up their statements, showing that the children performed better on tasks when completed in their preferred lighting environment. [6]

Fluorescent light tubes also contain the heavy metal mercury, and phosphorus, and children can be exposed to the small amounts of gases emitted by the light as it ionizes the mercury. The symptoms of exposure to mercury can include headaches, mood swings, tremors and decreased cognitive functions. [7]
LED stands for Light Emitting Diode. The main difference between these and normal fluorescent lighting is that they emit a very narrow band wavelength of light compared to the wider band fluorescent. While they are generally more efficient than standard fluorescents, and cheaper to run, the technology is more expensive, thus they cost more upfront.

As far as the effects on student performance go, the jury is still out. Teachers and students alike have reported that LED lighting makes for a more pleasant environment, but it is the effect on the human eye that is driving debate, which revolves around the blue light emitted by white LED’s. These are used in smartphones and tablets, and as our use of these increases, so do the possibilities for damage to the cells of the retina.

Perhaps better than switching from fluorescent lighting to LED’s, the potential of full-spectrum and dynamic lighting may be the answer.
As human beings, we are built to respond best to natural sunlight. It has a soft, diffused quality that varies in colour and intensity that electric lighting just cannot simulate. So, classrooms should make the most of all the available natural light entering the room. And there can be a vast difference between the natural light available at the front and back of the room, and near the windows.

Researchers have suggested that the solution to lighting issues in the classroom should be to more closely emulate the qualities natural light. This can be achieved by using full-spectrum and dynamic lighting solutions.

**Full-spectrum lighting**

Full spectrum lights, as their name suggests, emit light in all visible wavelengths, which means that they more closely resemble natural sunlight. Children who study in classrooms fitted with full-spectrum lights “experience less stress and anxiety, improved behaviour, attitude and health, and increased academic performance and achievement.”[8]
Dynamic lighting

This refers to the use of different kinds of light depending on the requirements of the task and the time of day. The aforementioned Korean research group [9] concluded that lighting can, and should, be optimized to individual tasks using the different correlated colour temperatures (CCT’s) of light, varying from “warm” to “cool”. They found that this simple adjustment to the classroom environment made students more alert and improved their academic performance.

There is no doubt that children work best in an environment where they feel safe and comfortable. And lighting their environment is a critical factor in the sense of well-being they experience, whether that be in the classroom, the school canteen, or at home in their own bedrooms.

More information on our 20-Day Classroom Detox course can be found at the link below: www.lifeskills4kids.com.au/20-day-classroom-detox
At Life Skills 4 Kids, we are passionate about helping parents and teachers of children with sensory processing issues to create a safer, more inclusive environment in which their children and students are encouraged to learn.

With this in mind, we have created an online course, specifically designed to address the issues confronting teachers in the classroom. This is our 20-Day Classroom Detox course. Once enrolled, you will receive a daily ‘tip’ delivered to your nominated email address each week day for four weeks. These tips provide invaluable suggestions on how you can improve the classroom environment in small ways that will have big impact.

You will also be provided with access to a curriculum that addresses the following:

- How to identify potential environmental issues
- Solutions that provide a structure from which you can problem solve potential classroom environment issues
- Pictorial and case study examples that make these strategies easy to grasp
To cater for different learning styles, the course content is delivered in different modes from day to day and include:

- Written introductions each day to get you started
- Videos that step you through the processes described
- Transcripts of the video – for those who like to skim read
- A printable workbook to help you work through your task of the day
- Strategies and ideas you can apply immediately in your classroom

Over 20 days, you will explore the following topics:

- Your Classroom’s Visual Baseline
- Glare
- Visual Busy-ness & Eye Fatigue
- Lighting
- The Just Right Kids Model
- Auditory Factors
- Fidgety Fingers
- Calming Techniques
- Oral Factors
- Seating and Desk Audit
- Movement
- Muscle Activities
- Retreat Areas
- Playgrounds


More information on our 20-Day Classroom Detox course can be found at the link below: