

thin^xtra
Enabling Massive IoT

Ventilation is the
new vaccination:
How to implement
CO2 monitoring
as the first step
toward safer
indoor air





Introduction

Australian and New Zealand (ANZ) schools are learning to live with COVID-19 in the community.

As we look for ways to combat rising infection levels, we can harness new user-friendly technologies to get the information schools need to provide a safe learning and working environment.

The need for adequate ventilation is well-known as a means of suppressing the spread of the virus.

Less well-known is the role of carbon dioxide monitoring devices connected to the Internet of Things to give schools the data they need to keep children, teachers, staff and families safe.

In this eBook you'll learn about:

- ✓ How schools and other education facilities are faring in the battle to provide a safe, uninterrupted education
- ✓ The role of ventilation, air quality and carbon dioxide monitoring in ensuring a safe learning environment
- ✓ Why schools need to act quickly to monitor and improve classroom ventilation for the long term
- ✓ How the Internet of Things, and Thinxtra's Massive IoT solution in particular, can provide a quick, convenient, affordable solution to air quality monitoring in schools.



Schools at the vanguard of the fight against COVID-19

Schools are on the front line of the battle against COVID-19 as students have returned to the classroom after extended periods of home learning.

While learning in a classroom environment achieves the best educational outcomes for most children, indoor environments are far from ideal when it comes to safeguarding children, teachers and staff against the spread of pathogens such as COVID-19.

Classrooms may house up to 30 children in one room for 5 to 6 hours, with seating arrangements that make social

distancing difficult. With a level of talking and chatter that results in an increased concentration of any airborne pathogen that may be in the environment, entire classes can become infected with COVID-19 in a single day.¹

As governments encourage a return to normality, it's more important than ever that schools implement proven, effective, environmental controls – such as improved ventilation – that are available to them to help limit the spread of COVID-19.

As governments encourage a return to normality, it's more important than ever that schools implement proven, effective, environmental controls – such as improved ventilation – that are available to them to help limit the spread of COVID-19.

¹The Drum, ABC, [Interview with Lidia Morawska](#), Distinguished Professor in the School of Earth and Atmospheric Sciences at Queensland University of Technology.

The importance of good ventilation

It's now well-known that the spread of airborne respiratory diseases such as COVID-19 in indoor environments may be addressed through improved ventilation, bringing issues of air quality and monitoring to the fore.

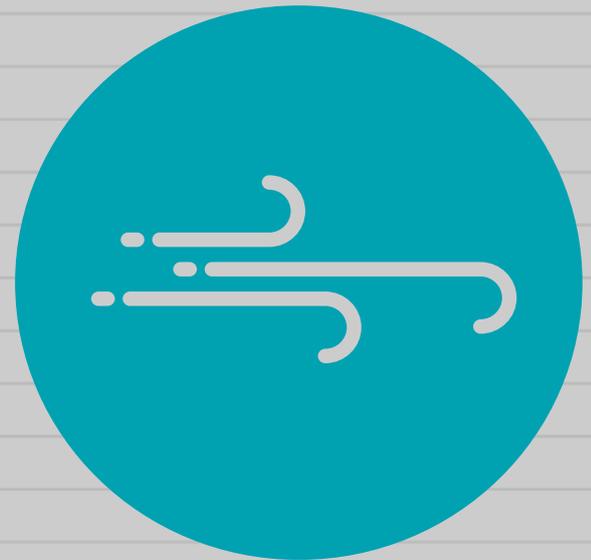
The World Green Building Council maintains that enhancing indoor air quality can be as effective in reducing aerosol transmission of viruses as vaccinating 50 to 60 per cent of the population.²

It's a view that is backed by the World Health Organisation: "Understanding and controlling building ventilation can improve the quality of the air we breathe and reduce the risk of indoor health concerns including preventing the virus that causes COVID-19 from spreading indoors."³

Poor air quality in classrooms

Ventilation in Australian and New Zealand classrooms is often either unmeasured or insufficient, and many school children may be learning in classrooms with poor indoor air quality that doesn't meet safety guidelines.

A team from the UNSW Sydney's School of Built Environment found concentrations of carbon dioxide (CO₂) in classrooms peaked significantly higher than the 850-ppm (parts per million), a threshold prescribed by the National Construction Code due to a lack of proper ventilation.



The World Green Building Council

maintains that enhancing indoor air quality can be as effective in reducing aerosol transmission of viruses as vaccinating 50 to 60 per cent of the population.²

² Covid brings indoor air quality monitoring upfront, World Green Building Councils,

³Roadmap to improve and ensure good indoor ventilation in the context of COVID-19, World Health Organisation

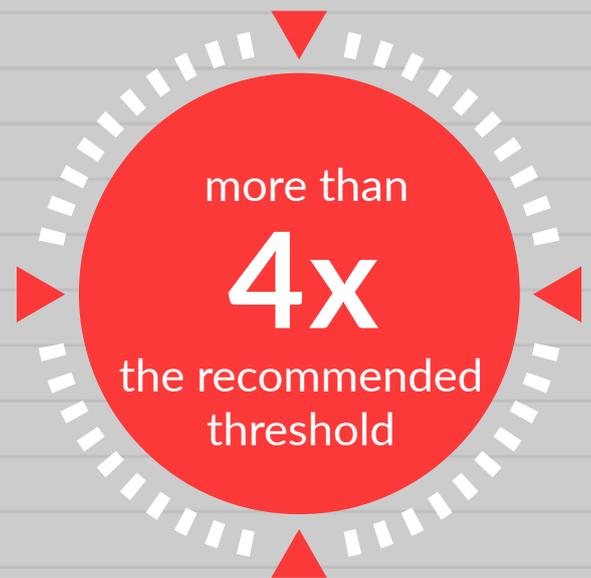
The study also showed that low ventilation rates raise the concentration of other contaminants in a classroom environment, such as emissions from the building materials and furniture, and particulate matter from indoor and outdoor sources.

While each state in Australia has its guidelines for indoor air quality in

schools, classroom ventilation typically relies upon natural and manual airing, which is not always possible. Often, windows are closed to optimise energy management and minimise external noise from people, traffic and construction, and to avoid disruption from extreme weather.⁴

A UNSW study found that high CO₂ released by the occupants of a classroom can lead to fatigue, concentration loss, and poor learning performance.

Previous research conducted by UNSW Professor Mat Santamouris found **CO₂ levels of up to 4000 ppm in classrooms**



and close to workplace hazardous at 5,000 ppm.

⁴Poor air quality in classrooms detrimental to kids' wellbeing and learning, UNSW

Why CO2 monitoring is essential to manage poor ventilation

The first step in addressing poor air quality is to measure the state of ventilation in schools, according to one of the world's foremost authorities on the impact of airborne particles on human health and the environment, Lidia Morawska, a Distinguished Professor in the School of Earth and Atmospheric Sciences at Queensland University of Technology.

Ms Morawska says it should be mandatory that building occupants get real-time information on the quality of the air they are breathing, such as by measuring CO2 levels in classrooms. CO2 is the best proxy for indoor air quality because we exhale CO₂ when we breathe, so the higher the concentration,

the poorer the ventilation. It is also much easier to measure CO2 levels than measuring the aerosols or COVID-19 virus particles themselves.

“Wide use of monitors displaying the state of indoor air quality must be mandated because the general public currently have no way of knowing the condition of indoor spaces they occupy and share with others,”⁵ Ms Morawska says.

“Not only every school [but] every public building should have a CO2 monitor on the wall so people know what the situation is and the adults who operate the building can be held accountable.”⁶



“Not only every school [but] every public building should have a CO2 monitor on the wall so people know what the situation is and the adults who operate the building can be held accountable”

– Lidia Morawska, Distinguished Professor, School of Earth and Atmospheric Sciences, Queensland University of Technology

⁵ Making sense of IAQ, Climate Control News, 2 November 2021.

⁶ The Drum, ABC, Interview with Lidia Morawska, Distinguished Professor in the School of Earth and Atmospheric Sciences at Queensland University of Technology.

Higher temperature and higher relative humidity potentially reduce the transmission risk of COVID-19, according to a 2021 modelling study in China and the United States.

In addition to CO₂, humidity and temperature are also strong indicators of the potential for COVID-19 to spread within an indoor environment.

Higher temperature and higher relative humidity potentially minimise the

transmission risk of COVID-19, according to an in-depth modelling study in China and the United States conducted in 2021 that found even a 1 per cent variation of both measures could impact transmission rates.⁷

Multiple benefits of improved air quality in schools

Measuring CO₂ and improving air ventilation and air quality where needed in schools offers a range of benefits, including:

- ✓ A safer environment and reduced risk of contracting COVID-19 for children, staff and parents
- ✓ Reduces risk of disruption and need for lock downs
- ✓ An environment that promotes cognitive performance, based on studies showing workers' performance improves in buildings with enhanced ventilation.⁸

In Australia, the Victorian government was one of the first to make CO₂ monitoring, ventilation and air filtering part of its plan for a safe return to schools⁹ while the New Zealand government announced in January 2022 that it would distribute 2500 CO₂ monitors to help schools identify areas with poor ventilation.¹⁰

⁷ Impact of temperature and relative humidity on the transmission of COVID-19: a modelling study in China and the United States

⁸ The Impact of Green Buildings on Cognitive Function

⁹ Portable CO₂ meters could be used to help fight coronavirus transmission, experts say, ABC Online, 11 September 2021.

¹⁰ Covid-19 NZ: Government orders 5000 air cleaners for schools, but just 500 will be ready by March, Stuff.co.nz, 25 January 2022.



Ventilation: An issue that can no longer be ignored

The need to address air quality in schools, like the need to offer home-based RAT tests, is already an imperative.

If infection rates are seen to spike in schools that fail to address air quality and ventilation in classrooms, it is likely to result in adverse publicity.

Future spikes in pandemic infection rates are expected. It's incumbent upon school principals, building and facilities managers, and health and safety officers alike to take every reasonable measure to suppress outbreaks.

4 Reasons to monitor CO2 levels and ventilation



1

Know where to invest in ventilation remedies and minimise cost

2

Manage transmission risk where and when it is needed

3

Minimise infections, absenteeism and disruption of operations

4

Manage risk and provide stakeholders with historical reports of indoor air quality

Minimise disruption by reducing transmission risks

As COVID-19 progresses towards endemicity, in which it has a constant, somewhat expected presence in the community, its impact on classroom learning along the way is far from predictable.

As the pandemic evolves, classes at schools throughout the country are being confronted with high levels of COVID-19 infections.

Tens of thousands of students have missed school since the return to

face-to-face learning in 2022 amid a resurgence of COVID-19 across the country.¹¹

Against that backdrop, it's important schools take every possible measure to protect against transmission to minimise infection, absenteeism and disruption.

Monitoring CO2 in classrooms allows schools quickly to identify when ventilation is inadequate and demands appropriate remedies.



Australians spend **90 per cent or more of their time indoors**, and the CSIRO estimates the cost of poor indoor air quality in Australia may be as high as **\$12 billion per year**.

Monitoring indoor air quality is a cost-effective solution

Since the WHO acknowledged in 2021 that COVID-19 was an airborne virus¹², the issue of improving air quality in public buildings has had widespread exposure globally.

Monitoring and designing safer environments is known to be a cost-effective way of limiting the spread of the virus, with building operators and

managers increasingly likely to be held accountable for air quality and ventilation in the buildings they manage.

Australians spend 90 per cent or more of their time indoors, and the CSIRO estimates the cost of poor indoor air quality in Australia may be as high as \$12 billion per year.¹³

¹¹Thousands of students miss school amid rise in COVID-19 cases, The Sydney Morning Herald, 25 March 2022.

¹²WHO finally admits Coronavirus is airborne. It's too late, Forbes, 4 May 2021

¹³Indoor air quality, Australia: State of the Environment, 2016

“We are paying a much, much bigger cost as a society and a country if we are not doing anything about inadequate air and air pollution.”

– Lidia Morawska, Distinguished Professor, School of Earth and Atmospheric Sciences, Queensland University of Technology

The combined human and economic costs of doing nothing about air quality monitoring are too high, according to Lidia Morawska.

“We are paying a much, much bigger cost as a society and a country if we are not doing anything about inadequate air and air pollution.”

Within schools, continuous 24/7, affordable CO2 monitoring in classrooms can be used to reveal poor air quality and ventilation within minutes.

Studies have shown that improving ventilation can reduce the incidence of COVID-19 by 39 per cent¹⁵, improving student and teacher health and safety outcomes while also reducing other incurred costs, such as the need to hire casual teachers.

“It’s an economic no-brainer to invest [in better air quality] in schools,” says Jeffrey Siegel, Professor of Civil Engineering at the University of Toronto.

Potential exposure to damage claims

As employers, schools have a duty of care to maintain a safe workplace “as far as is reasonably practicable”.

Employees who can show they caught COVID-19 – particularly long COVID – can claim workers’ compensation for medical expenses and lost income.¹⁶ In some states, there is a ‘presumption’ for certain occupations that catching COVID is a result of their work. In NSW, this list of front-line workers includes teachers – which places schools that

don’t address ventilation potentially in the frame of future long COVID damages claims.

“It’s an economic no-brainer to invest [in better air quality] in schools,”

– Jeffrey Siegel, Professor of Civil Engineering University of Toronto

¹⁴Australia’s air quality culture criticised as experts point to ventilation as key in COVID-19 fight, ABC Online, 25 August 2021.

¹⁵Portable CO2 meters could be used to help fight coronavirus transmission, experts say, ABC Online, 11 September 2021.

¹⁶If I catch Covid-19 at work, what are my rights?, UTS website, 25 October, 2021



How CO2 monitoring with Thinextra's IoT solution improves air quality in schools

The right ventilation and air quality has never been more important to provide a safe and Covid-19 resilient "back to work environment" in schools.

Air quality can be monitored in schools quickly and cost-effectively with an Internet of Things (IoT) solution.



Thinextra's technology solution has been specifically designed for organisations that need to:

- ✓ Minimise the initial deployment and ongoing maintenance cost of CO2 monitoring
- ✓ Remove the burden of manual room-by-room readings and reporting which is prone to human error
- ✓ Have up to date data and visibility across all rooms and all buildings without the need to be on site at all times
- ✓ Avoid complex technology that requires expensive specialist skills and knowledge
- ✓ Eliminate ongoing maintenance including the need to manually calibrate CO2 monitors, exchange batteries, record measurements or create reports
- ✓ Deploy a solution quickly and easily without disrupting operations or requiring additional power or wiring, network extensions and connections, or security measures



Who we are

Thinextra is a leader in Massive IOT and the exclusive operator of the national Thinextra OG Network in Australia, NZ and Hong Kong, the only public, low-cost, low power wide area network (LPWAN).

We help organisations connect their physical assets to the digital world through a range of plug and play or custom IoT solutions that provide data insights to help deliver value and efficiencies for a more sustainable world.

Through our OG Network, the experience of skilled IoT professionals and broad ecosystem of solution partners, Thinextra makes IoT accessible to schools and other organisations, enabling the next evolution of digital transformation.

thinextra
Enabling Massive IoT



Thinextra's IoT-enabled CO2 monitoring solution

Monitor the indoor air quality and ventilation in your school in three simple steps with Thinextra:

1

Install Thinextra's battery-powered CO2 monitors in classrooms

- ✓ Easily fit battery-powered monitors in classrooms in minutes, with no wiring needed
- ✓ Air travels through the sensors which measure CO2, temperature and humidity
- ✓ No technology or specialists skills are required

2

Connect your monitors to the Internet of Things via Thinextra's wireless 0G Network

- ✓ CO2 monitors simply connect to Thinextra's 0G Network with no Wi-Fi or network infrastructure required
- ✓ Data begins to be transmitted securely and reliably to the cloud
- ✓ Updates occur every 30 minutes, providing a continuous flow of information

3

Continuously monitor the air quality and ventilation at your school

- ✓ Visualise and access the up-to-date data you need, anywhere, anytime
- ✓ Receive alerts when pre-set thresholds are met
- ✓ Get the reports you need for compliance and communication purposes

This enables school executive teams to take rapid action to identify and address inadequate ventilation anywhere on the premises.

Building and Facilities management is rapidly shifting to becoming a data-driven industry. An IoT CO2 monitoring solution is a great way to get the classroom ventilation data you need to the right person at the right time.



Product features



Measures indoor CO2, temperature and humidity

- ✓ Accurate, regular measurements inform you of COVID-19 transmission risks



Quick & easy installation

- ✓ Simple DIY installation, no tech support needed
- ✓ Get up and running within minutes



Maintenance-free

- ✓ No wiring or power supply required
- ✓ 5 years battery life



Wireless

- ✓ No Wi-Fi connection needed
- ✓ Operates independently of your infrastructure



24/7 monitoring

- ✓ Up-to-date readings every 30 minutes
- ✓ Receive instant threshold alerts



Conclusion

As we work towards a post-pandemic future, schools must take every reasonable opportunity to provide a safe learning and working environment for children and teachers.

Poor ventilation is known to be a contributor to COVID-19 transmission risks, but many schools are unable to measure air quality in their classrooms.

Thinextra's Massive IoT solution, in which CO2 monitors connect to our low-power OG Network and supply continuous classroom air quality data, provides an affordable, convenient, low-touch solution that can help ensure children and teachers feel just as safe about the air they breathe as they feel about the water they drink.

What's next? Speak to one of our consultants today to learn how to provide a safer, more comfortable environment for students, staff and visitors.

Contact us today!

info@thinextra.com

thinextra.com

