TRANFORM AIR QUALITY INTO STUDENT ACHIEVEMENT

Better indoor air quality can provide significant benefits for educational spaces, helping students and teachers stay focused, comfortable, and healthy.

And improving air quality doesn't have to mean an extensive overhaul – it can be as simple as giving your HVAC system the data to know when to ventilate, automatically.

Why indoor air quality matters for schools

For more than a decade, organizations such as the EPA have been reporting that better indoor air quality (IAQ) can make measurable improvements to student performance.[1] Likewise, in the wake of the pandemic, the CDC advises that better air quality can help schools become measurably safer.[2]

And when it comes to improving air quality, one of the most effective methods – in terms of both results and cost – is enabling your HVAC system to monitor carbon dioxide levels to detect when ventilation is needed.

CO_2 levels are an essential method of determining air quality

As CO_2 levels increase, air quality is reduced, with a variety of potential negative effects on cognitive function, such as loss of focus, decreased productivity, and fatigue.[3]

CO_2 levels are also a good measure of occupancy levels. As the number of people in a room increases, CO_2 also increases – and hence air quality again declines.

Yet around the world, studies find that in many classrooms, CO_2 levels are too high. For example, according to a 2019 study by Lawrence Berkeley National Laboratory and the University of California-Davis, "researchers found that about 85% of 94 recently installed HVAC systems in California K-12 classrooms did not provide adequate ventilation."[4]

CO_2 levels can tell you whether you ventilate enough

Beyond carbon dioxide itself, poor or inadequate ventilation can also lead to high levels of other irritants and contaminants in the air – such as allergens, microbes and pathogens, unpleasant odors, and pollutants like fine particulate matter and volatile organic compounds.

Particulate matter (PM), which often comes from outdoor pollution, consists of micron-sized particles from sources such as vehicle exhaust, power plants, and fires. These microscopic particles are harmful to breathe, yet easy to inhale.

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Volatile organic compounds (VOCs), which often come from indoor pollution, consist of chemicals and gasses from sources such as cleaning products, furniture, and other building materials.

And when CO_2 is high, it's more likely that PM and VOC levels will also be high.

Ventilation shouldn't be all or nothing

Ventilation brings in fresh outside air to reduce the concentration of contaminants such as CO_2 and VOCs, while filtration helps reduce contaminants such as allergens and particulate matter.

Yet the baseline ventilation levels set by local building codes are not necessarily sufficient for the actual conditions in a building or room.

When a classroom is full, additional ventilation may be needed to maintain suitable air quality. And when people are concentrated in one area – such as an assembly in the gym – you might need more ventilation there, yet little or none in empty classrooms.

So this leads to several questions: When do you actually need to ventilate, and how much? How do you know if your ventilation is effective? And how do you know when you're wasting energy (and money) by ventilating too much?

Using sensors to track CO_2 levels is an effective way to resolve these questions.

How CO_2 data can optimize ventilation

If CO_2 levels regularly exceed appropriate limits, this lets you know that you need to ventilate more.

If the CO_2 level is fine at low occupancy, yet exceeds the threshold when a classroom is full, this could mean your ventilation system struggles to keep up on busy school days.

So measuring CO_2 during peak occupancy can be a good indicator of whether your ventilation system needs service or alterations.

And when you know a classroom's CO_2 level in real time, you can implement ventilation on demand – automatically bringing in fresh air only as it's needed. This saves energy compared to constant ventilation.

In a 2019 study, **85% of recent HVAC systems** did not provide sufficient ventilation in California classrooms.[4]

California schools now require CO_2 monitoring

As of January 1, 2021, California requires CO_2 monitors in all classrooms, under Public Utilities Code 1625.

The state has also established the California Schools Healthy Air, Plumbing, and Efficiency (CalSHAPE) Ventilation Program to support schools with funding and guidelines for monitoring CO_2 levels in classrooms.

CalSHAPE Ventilation guidelines provide a variety of specific requirements, such as:

- a sensor that can provide CO_2 readings, on the device or via digital app

- a way to alert staff when CO_2 levels exceed 1,100 parts per million (ppm), such as a warning light or mobile alert

- a measurement range of 400 to 2,000 ppm

- certified accuracy within 75 ppm (at a CO_2 concentration of 1,000 ppm)

- a sensor that does not need calibration more than once every 5 years

- the ability to log maximum CO_2 measurements

And based on those sensing capabilities, the guidelines also indicate that if a classroom's CO_2 level exceeds 1,100 ppm more than once a week, the ventilation should be adjusted.

CO_2 sensing made simple

Although many carbon dioxide sensors are unable to meet California's guidelines, Honeywell's cost-effective $CO2_2$ sensors do – providing precise capabilities that go well beyond.

Our self-calibrating sensors can monitor any zones and rooms within the building, mounted discreetly on a central column or wall in each classroom.

The sensor's CO_2 threshold can be set at your desired limit (e.g., 1,100 ppm), with a visual readout and a red LED to indicate when the limit is exceeded. The sensors are also easy to integrate with your HVAC system for web-based readouts and centralized tracking, as well as automated ventilation on demand.

Funding support is available

Fortunately, funding is available to help schools improve indoor air quality, including government programs, grants, and other potential sources.

In particular, the CalSHAPE Ventilation Program has established state funding to support classroom CO_2 monitoring. And we're here to help you navigate the process: to understand how to leverage the funds, determine the upgrades that would most benefit your school or district, and which improvements qualify for funding.

Healthier schools start with cleaner air

And cleaner air starts with better data – from Honeywell

hwll.co/CO2detection

Honeywell CO_2 Sensor (model C7233)

1. "Student Health and Academic Performance – Quick Reference Guide," Environmental Protection Agency (EPA), Nov. 2012.

2. "Ventilation in Schools and Childcare Programs," Centers for Disease Control and Prevention (CDC), updated 26 Feb. 2021. Accessed 9 Feb. 2022: https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/ventilation.html

3. "Why Indoor Air Quality is Important to Schools," Environmental Protection Agency (EPA). Accessed on 17 Feb. 2022: https://www.epa.gov/iaq-schools/why-indoor-air-quality-important-schools

4. "Improving Indoor Air Quality in California Schools," Western Cooling Efficiency Center, University of California–Davis. Accessed on 17 Feb. 2022: https://wcec.ucdavis.edu/improving-indoor-air-quality-in-california-schools/

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