

# SiYtE for Schools: Safe, Suitable, Sustainable

## Are schools leaving attainment on the table because of poor classroom environments?

### What's wrong with school buildings?

There isn't enough money to address all the refurbishment and rebuilding needs of the school estate. Under the last government the capital plans for new-build schools involved 50 new schools a year. With 23,000 schools in the UK, each building was expected to have an operational life of over 400 years. This is simply not feasible.

### Why does that matter?

Older buildings often create surroundings with poor air quality, high ambient noise, and low environmental comfort. Over time buildings become less structurally healthy. Materials degrade; systems fail; and use changes in ways unplanned by the original designers.

For schools, this means there may be environmental conditions that are potentially detrimental to health and learning. Our environmental monitoring in schools has already proven there are CO<sub>2</sub> (Carbon Dioxide), TVOCs (Total volatile organic compounds), and noise at significantly elevated levels, way beyond the Department for Education's guidance. Other studies have identified high concentrations of particulate matter from external sources, such as busy roads, that are not filtered out from the school's air.

### What impact does that have on our children?

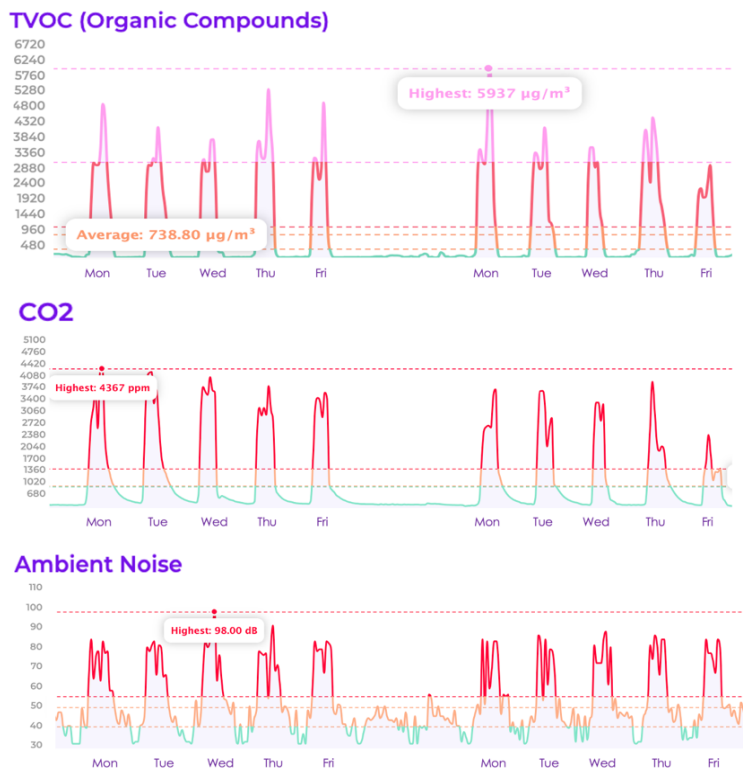
Poor air quality negatively influences cognitive performance, alongside its more widely known impact of damaging respiratory health and other related conditions. This impact on cognitive performance has only recently been understood thanks to research over the last decade. Evidence shows that when classrooms are too hot, noisy, and/or high in Carbon Dioxide (CO<sub>2</sub>) or organic compounds (TVOC), learning suffers detrimentally:

- Children exposed to noise above 65 decibels (dB) experience worse performance in reading, maths, and speed of thought exercises. <sup>1</sup>
- Higher temperatures increase fatigue and reduce cognitive function – every 0.5°C increase in temperature reduces learning effectiveness by 1%.<sup>2</sup>

- For every 500ppm (parts per million) increase in CO<sub>2</sub>, researchers at Harvard saw response times c.2% slower, and c.2.5% lower response accuracy,<sup>3</sup> with a greater impact on higher-order functions like strategy, information processing and initiative.<sup>4</sup>
- As well as their risk to health, researchers found a 13% reduction in cognitive function with every 500ug increase in volatile organic compounds measured.<sup>5</sup>

## Is this widespread?

Purple Transform has built an intuitive UI to deliver insights from sensors deployed in several English state schools. These range from relatively new buildings to Victorian-era estates.



All schools deployed have some level of air quality issue. Figure 1 is actual received data from a two-week monitoring period. The threshold breaches are a daily occurrence and are of an order of magnitude above recommended levels. This will have a serious effect on young people's cognitive performance and learning, as well as potentially on health. This therefore is a cross-government issue beyond just education.

This not only supports, but further adds to, the body of literature and research that has emerged in recent years highlighting school air quality challenges.

Figure 1: Two school-weeks of environmental quality data from a state primary school

<sup>3</sup> Shield, B M., and J E. Dockrell. "The effects of environmental and classroom noise on the academic attainments of primary school children." *The Journal of the Acoustical Society of America* 123(1). 2008.

<sup>3</sup> Goodman, Joshua, Michael Hurwitz, Jisung Park, and Jonathan Smith. "Heat and Learning." HKS Faculty Research Working Paper Series RWP18-014, May 2018

<sup>3</sup> Jose Guillermo Cedeño Laurent et al, 2021, *Environ. Res. Lett.* 16 094047

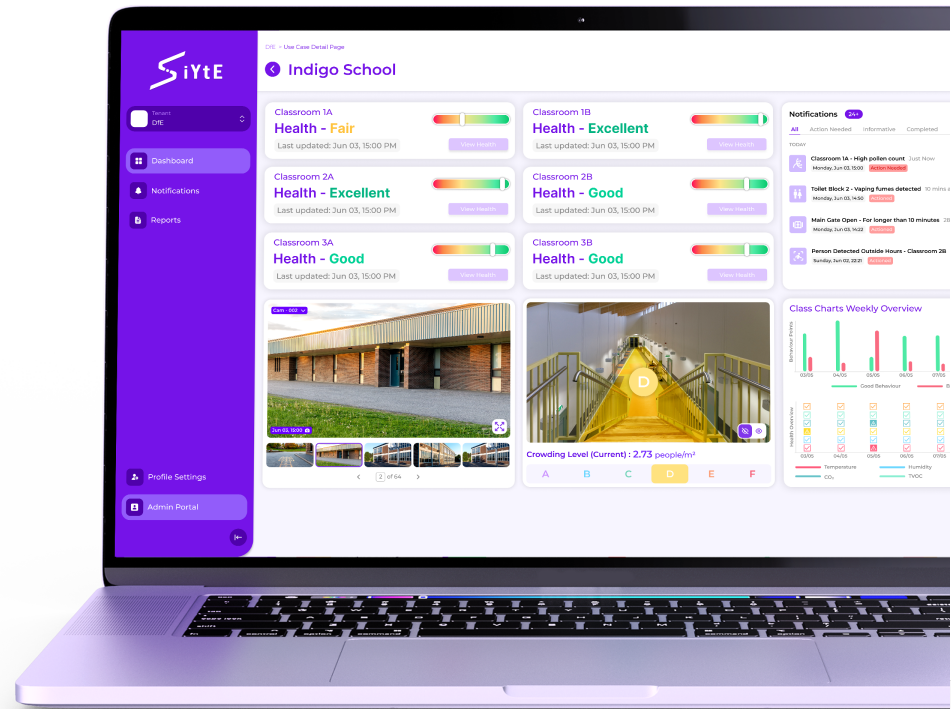
<sup>4</sup> Usha Satish, Mark J. Mendell, Krishnamurthy Shekhar, Toshifumi Hotchi, Douglas Sullivan, Siegfried Streufert, and William J. Fisk; Is CO<sub>2</sub> an Indoor Pollutant? Direct Effects of Low-to-Moderate CO<sub>2</sub> Concentrations on Human Decision-Making Performance; *Environmental Health Perspectives* 120:12; CID: <https://doi.org/10.1289/ehp.1104789>

<sup>5</sup> Allen, Joseph G., Piers MacNaughton, Usha Satish, Suresh Santanam, Jose Vallarino, and John D. Spengler. 2015. "Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments." *Environmental Health Perspectives* 124 (6): 805-812. doi:10.1289/ehp.1510037. <http://dx.doi.org/10.1289/ehp.1510037>.

## What can we do about it?

Our work with the education sector has been able to give schools the information they need to make their classrooms as safe, sustainable, and suitable for learning as possible.

As previously stated, a cohort of schools have deployed sensors in classrooms that provide environmental information back to the teacher through Purple's SiYtE platform. The teacher is then able to make the necessary interventions – opening/closing windows, blinds, HVAC operation or noise reduction.



This information also rolls up to the school and Trust level for review of the performance of the school estate as a learning environment. This importantly builds required business cases for funding to resolve.

## What about classrooms or buildings that can't be fixed?

At a school or MAT level, this environmental monitoring information will help those with previously hidden urgent needs for capital works to come forward and enable improved prioritisation of those with the most need. The Department for Education has limited capital budgets for school buildings and so must prioritise based on the measured impact on learning.

The information from the SiYtE platform can be used at an aggregate level to provide the data points to support prioritisation. The department will know which buildings are providing good learning environments, and which are not. When correlated with the structural health information the Department and schools already hold, SiYtE can provide further insights as to which schools and buildings most urgently need capital works. This delivers value for money to taxpayers through appropriate allocation of funding.

## So, what should schools do?

The first step is that school leaders need to understand their environment. Most schools lack any visibility of air quality and its impact on pupils' learning. An initial baselining of the condition of classrooms, or blocks, will quickly identify areas that need further exploration.

Only a few weeks of data is sufficient to understand the current environment quality and its likely impact on learning.

Once this is understood there will be a range of actions the school can take to alleviate any issues. These will range from simple micro-actions such as opening windows to create better airflow, through to HVAC/BMS system adjustments. For those issues that cannot be resolved through behaviour, use or system changes there may be a need for more structural interventions. The environmental data provides crucial evidence for any refurbishment or rebuilding business case.

### How can Purple Transform help?

We can help schools to understand their environment. Our SiYtE platform takes in data from any type of air quality sensor or building management system to give schools the insight needed. SiYtE's strengths are:

- Aggregation of data from disparate systems (sensors, cameras, APIs)
- Simple, flexible and easy to understand dashboards for extended user groups, accessible in classrooms, to teachers, to heads and school trusts.
- Flexible workflow to create simple to understand, flexible alerts via email, SMS or mobile.

**For more information or a demonstration please contact [info@purpletransform.com](mailto:info@purpletransform.com)**