

THE IMPACT OF INDOOR ENVIRONMENT QUALITY ON COGNITIVE FUNCTION

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As we head into 2022, a year marked by the great migration back to the office environment, there is much focus on indoor air quality, ensuring employers, building managers and facility managers are taking every precaution to keep their employees and occupants safe from the transmission of COVID-19.

What you might not know, because all of the focus is on COVID-19, is that recent studies around indoor air quality are also showing a direct correlation to improved cognitive function.

This was the subject of a previous [QED whitepaper](#) back in September 2019, however at that time the research was conducted in a 'laboratory' setting.

As you will read in this paper, the results are in, based on real world research, and the quality of the air you breathe does indeed have a direct correlation on your cognitive performance!

In the past two years, the pandemic of COVID19 and associated lockdowns led people to adapt to working from home. Now, that most Australian states have allowed full occupancy, it is important to ensure that people feel safe and ready to come back to the office.

While a high attention is given to ventilation to prevent COVID19 infections, many other indoor air quality issues related to productivity appear to have less of a focus.

Latest research conducted by Harvard Chan School (Cedeño Laurent et al., 2021) found that high concentration of carbon dioxide (CO₂) and fine particulate matter (PM_{2.5}) were associated with poor cognitive performance. While CO₂ was recognised in the COVID19 prevention (Peng & Jimenez, 2021) as it serves as a proxy to determine ventilation rates, PM_{2.5} has been silently affecting occupants' mental health (Wang et al., 2021). PM_{2.5} are small particles with a diameter of 2.5 micrometres or less. These particles are a common pollutant arising from combustion and car exhaust and can infiltrate inside of buildings. PM_{2.5} particles are very small and once inhaled they can get deep into the lungs as well as into the bloodstream.

The Harvard Chan School research conducted rigorous tests to establish a relationship between high CO₂, PM_{2.5} levels and cognitive function. The worldwide research was conducted across many countries including the US, the UK, China, India, Mexico and Thailand with over 300 participants. The participants were required to do several tests to assess their cognitive performance at various levels of the pollutants.

Importantly, the methodology for this study was vastly updated from prior similar studies, measuring air quality parameters and the subjects' cognitive performance in their own workplaces as opposed to the simulated workplace of a laboratory.

The research found that the response to the cognitive assessment tests were slower and less accurate when the concentration of CO₂ and PM_{2.5} were high. The research concluded that poor indoor air quality can affect cognitive performance and health.

INDOOR AIR QUALITY

The results of Harvard Chan School research are supported by a recent review of literature conducted by Du et al. (2020) who reviewed 37 experimental studies on the impact of CO₂ concentration cognitive function. The review concluded that higher levels of CO₂ were associated with reduced speed of functions and affected high-level decision-making. Similarly, PM_{2.5} was found to adversely affect the cognitive performance among approximately 1,400 research participants in a bushfire affected area (Kim et al., 2020).

THERMAL COMFORT

Besides air quality, other indoor environmental quality (IEQ) parameters such as thermal comfort, lighting and acoustic comfort also has varied degree of effects on cognitive performance (Wang et al., 2021). It was found that reasoning and planning skills were corelated to the thermal comfort reported by people (Wang et al., 2021). Lan et al. (2020) reported a reduction in cognitive performance of occupant when they were not comfortable with the indoor air temperature.

ACOUSTIC COMFORT/NOISE LEVELS

One characteristic of modern office workspace is open plan work environment, which is prone to elevated noise levels. It was found that noise levels affect the extent of processing information and thereby reduce the cognitive performance (Wang et al., 2021). Otterbring et al. (2020) found that cognitive performance of occupant working in noisier open plan office was lower than those working in enclosed offices.

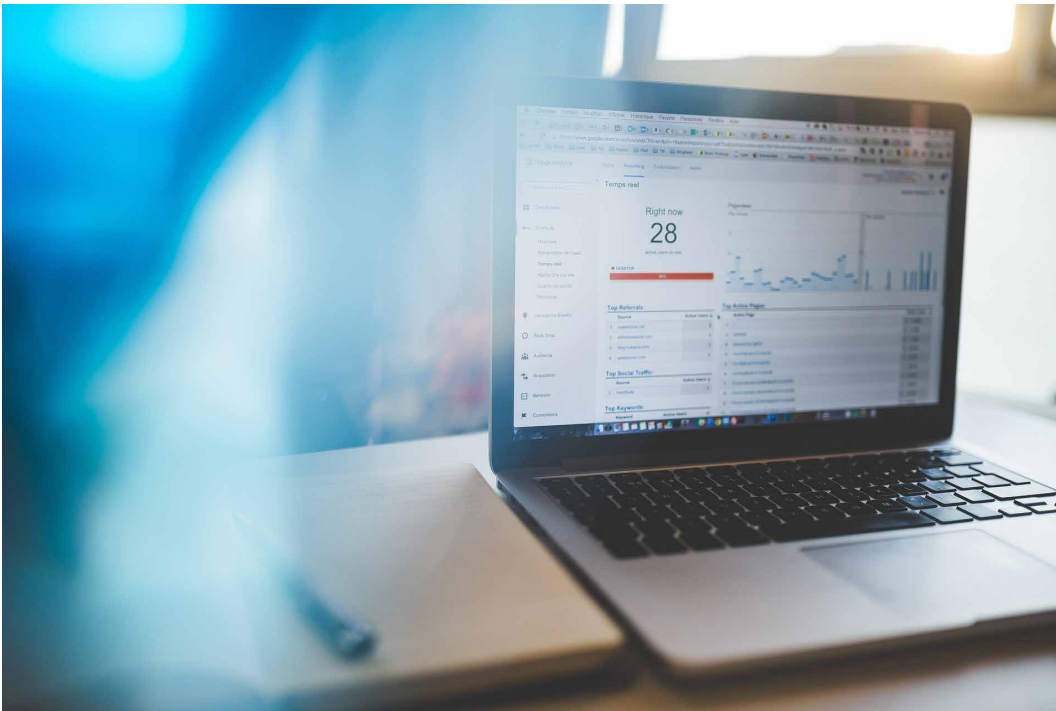


VISUAL COMFORT/LIGHTING LEVEL

Another aspect of IEQ – lighting – was also associated with cognitive performance. Better lighting quality was associated with improved performance in the studies reviewed by Wang et al. (2021). Boubekri et al. (2020) reported that optimum lighting levels and daylight improved decision making and cognitive performance in office workers.

THE EFFECTS OF IMPROVING INDOOR AIR QUALITY

While IEQ affects cognitive performance of the occupants, it also influences their satisfaction levels with the office. A recent study evaluated over 1,000 post occupancy surveys from traditional and WELL certified offices. WELL certification is aimed at improving occupant health and wellbeing – and the certification requires rigorous indoor environmental evaluation (IWBI, 2017). It was found that buildings with WELL certification were considered to be more satisfactory by the occupants (Candido et al., 2020).



IMPROVE IEQ TO IMPROVE ATTENDANCE

To ensure prevention of COVID19 spread the Australian government has provided guidance to improve ventilation rates (Australian Government, 2021). Improving ventilation rates also reduces the levels of CO₂ which, as discussed, influence the cognitive performance of occupants. A further improvement in IEQ, for example, reducing PM_{2.5} concentration and other pollutants would help to make offices more beneficial to the occupants' health and wellbeing. As people look forward to getting back to offices, having confidence the indoor air quality of their offices will not adversely affect their health and wellbeing, would be a strong motivation for people to get back to the “normal” times.

To improve the IEQ of an office building, the first step is to undertake a comprehensive assessment. At QED we have a highly skilled workforce of environmental scientists and microbiologists who can help to improve the IEQ of your office.

We are committed to improve the health and wellbeing standards in built environment. For more information on indoor air quality and how to assess its impact on employee performance visit www.qed.com.au or reach out to us at 1300 400 733.

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