SIE

Safe Breathing Spaces

Addressing Indoor Air Quality(IAQ) in schools

February 2025

In Association with

The Art & Science of Clean Air

YOGa

Introduction Indoor air quality (IAQ) is essential for safeguarding the health, productivity, and overall well-being of students, faculty and staff in schools. Poor IAQ can lead to health problems, hinder concentration, and increase the risk of long-term respiratory issues. This manual provides a detailed overview of indoor air quality in different classroom settings, presents real-time data, and offers actionable recommendations to enhance IAQ in schools and educational institutes.

Understanding Indoor Air Quality(IAQ)

PM2 .5

These fine particulate matter have an aerodynamic diameter of <=2.5 microns and can penetrate deep into the lungs and bloodstream, causing respiratory and cardiovascular problems.

CO_2

Elevated levels of carbon dioxide reduce cognitive function and are a marker of inadequate ventilation.

Health Impacts of Poor IAQ

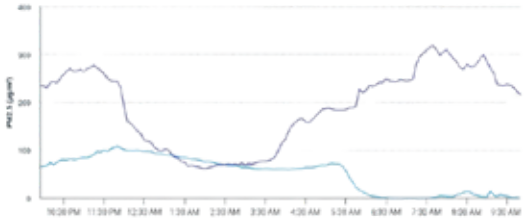
- Increased risk of respiratory conditions, including asthma.
- Decline in cognitive performance and academic outcomes.
- Higher absenteeism rates due to health complications.

Understanding Indoor Air Quality(IAQ)

IAQ Monitoring

- IAQ monitoring in schools ensures a healthy learning environment by measuring mainly two pollutants like PM2.5, CO2 levels.
- Poor air quality can impact students' concentration, health, and attendance. Continuous monitoring helps identify ventilation issues and mitigate risks like respiratory illnesses.
- Implementing IAQ solutions backed by monitoring enhances student well-being, academic performance, and overall school safety.

Various commercial grade monitors in monitors



IAQ Comparative trend at a school

Understanding Indoor Air Quality(IAQ)

IAQ Monitoring Guidelines

- Key Parameters: Focus on monitoring PM2.5 and CO2 levels.
- Sensor Selection: Use stable, low-cost sensors with real-time remote monitoring capabilities.
- Monitoring Duration: Conduct monitoring throughout the entire school hours with the sensor fixed at one location.
- Activity Log: Record all activities occurring during the monitoring period.
- Avoid Movement Bias: Do not rely on readings while walking with the monitor.
- Stabilization Time: Allow a minimum of 5 minutes for sensor stabilization to ensure accurate grab sample readings.

Current News, Insights, and Expert Opinions

Better Indoor Air, Better Health

“Ventilation Can Reduce Exposure to Respiratory Viruses in Indoor Spaces”,
Centre for Disease Control(US), March 22, 2024
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Improving ventilation, whether natural or mechanical (air flow, filtration, and air treatment), reduces the number of small respiratory virus particles in indoor air, helping lower the risk of transmission.

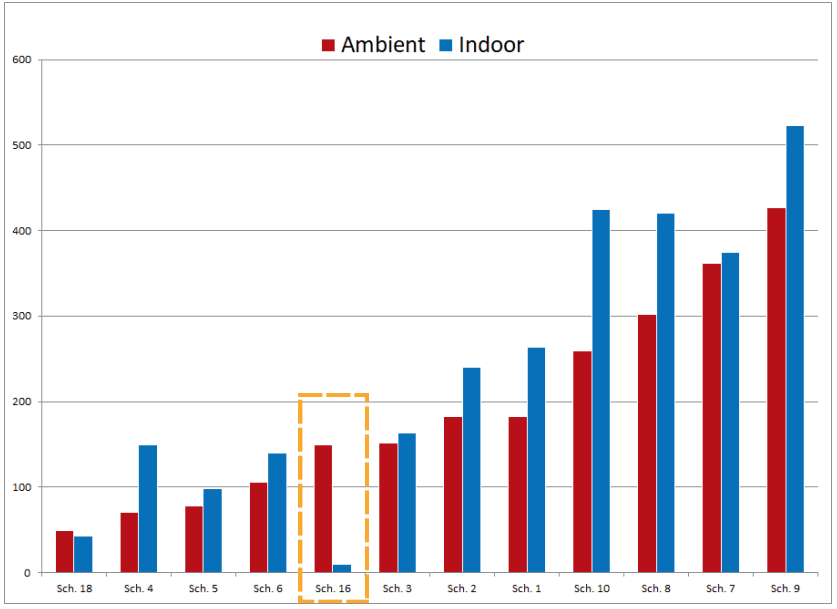
“Promoting indoor air quality and normative temperatures can support creative work.”
-
Associations between indoor environmental conditions and divergent creative thinking scores in the CogFx global buildings study, 15 February 2025

“It was revealed that by clearing the air of kindergartens alone, children’s illness was reduced by as much as 18.2%.... When we get such a big reduction just by cleaning up air, we can show that a significant proportion of diseases actually spread through air.
This provides us with a route to control diseases that we have not used before.”
-
A two year study in Helsinki day care centers

Assessing Classroom Air Quality:

SIE and YOGa's Study on Ventilation and Pollutants

SIE and YOGa Clean Air partnered to assess classroom air quality using iaq monitoring tools, following the guidelines of SIE for IAQ Monitoring.
The study compared PM2.5 and CO2 levels across naturally ventilated, mechanically ventilated, and hybrid classrooms.



Naturally Ventilated(NV) Classes

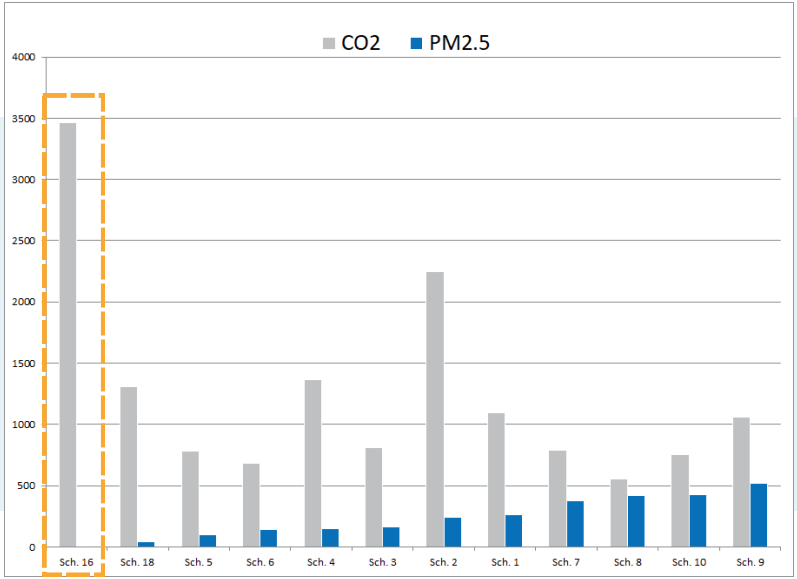
PM2.5 trends at natural ventilated classes showed that indoor levels mirrored ambient levels.

There is a **93% reduction in PM2.5 levels when an intervention is implemented in such a classroom.**

Assessing Classroom Air Quality

Naturally Ventilated(NV) Classes

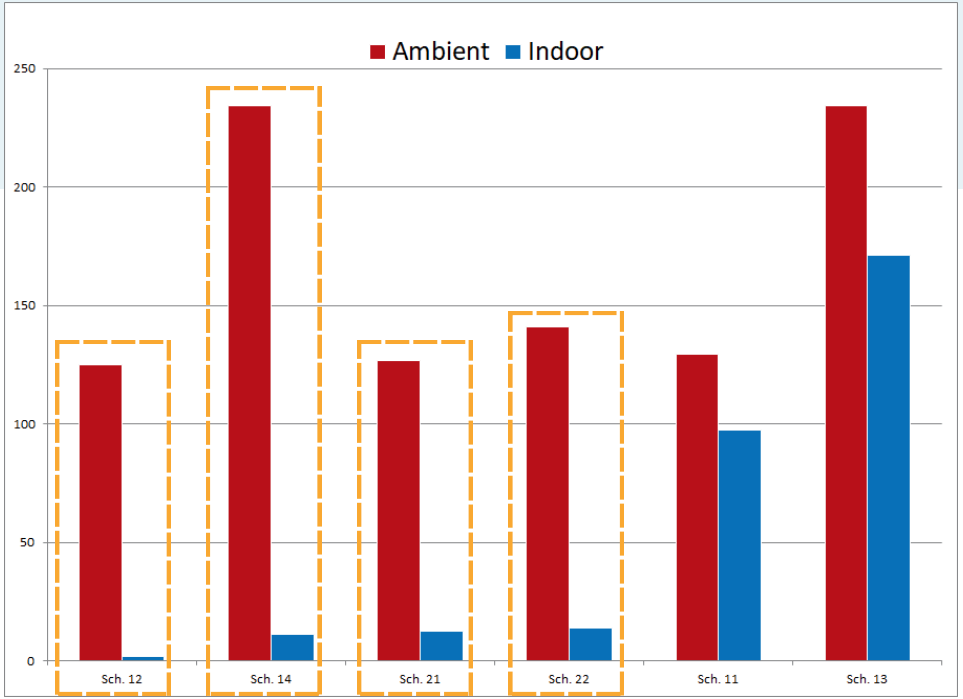
CO2 levels in NV classrooms usually remain below 1200 ppm. However, since many classes were tested during winter when windows remained closed, CO2 levels were observed higher in the classrooms.



At School 16, a reduction in PM2.5 levels was observed with the intervention. However, CO2 levels exceeded the usual levels due to a lack of ventilation in the classroom.

Assessing Classroom Air Quality:

Mechanical Ventilated(MV) Classrooms



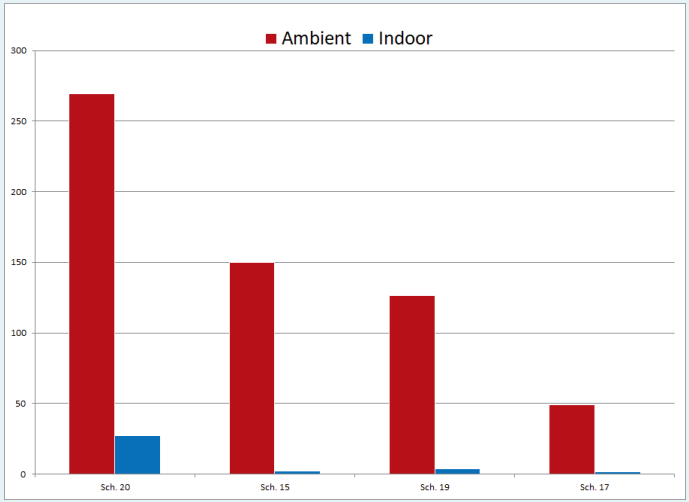
PM2.5 trends in MV classrooms also reflect ambient levels, as the system brings in fresh air from the outside without ***fine filtration for PM2.5 pollutants.***

There is a **95% reduction in PM2.5 levels when an intervention is implemented in such a classroom.**

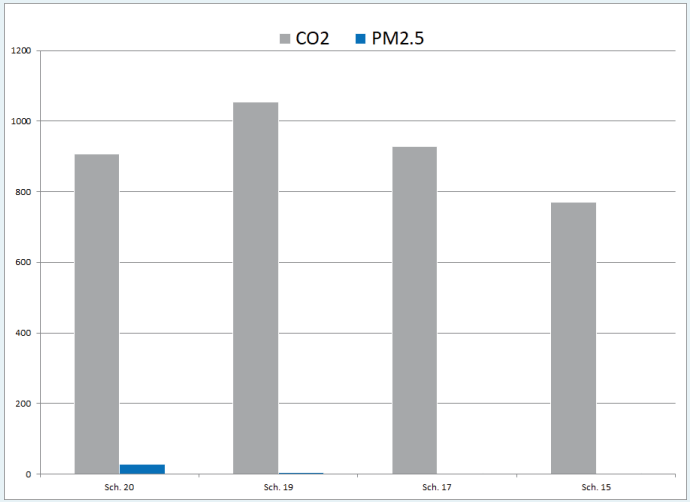
Assessing Classroom Air Quality

Hybrid Classrooms

A naturally ventilated classroom with mechanized intervention



PM2.5 levels shown 99% reduction



CO2 levels is also maintained below 1200ppm

Balancing Air Quality in Delhi Classrooms – A Case Study on PM2.5 and CO2 Levels

- This study analyzed air quality in 21 classrooms across Delhi, spanning both government and private schools.
- **Naturally ventilated classrooms** were the most affected, experiencing high PM2.5 exposure along with elevated CO2 levels due to limited ventilation.
- **Mechanized ventilated classrooms** demonstrated better CO2 control due to consistent ventilation. However, the lack of filtration meant they remained just as polluted as naturally ventilated spaces.
- **Interventions** in naturally ventilated classrooms successfully controlled PM2.5 levels, but CO2 spiked beyond acceptable limits due to insufficient ventilation. This study highlights the need for a balanced approach to ensure both clean air and proper ventilation in classrooms.
- **Hybrid classrooms** effectively managed both PM2.5 and CO2, maintaining levels within WHO's recommended limits—PM2.5 below 15 µg/m^3 and CO2 under 1200 ppm—by balancing ventilation and filtration.

Intervention Brings Improvement

ACTION PLAN FOR IMPROVING INDOOR AIR QUALITY (IAQ)

- School Administrators: Regularly monitor air quality, invest in purifiers and ventilation systems, prioritize IAQ in budgets, and conduct IAQ training.
- Teachers: Ensure ventilation during breaks, avoid harsh cleaning chemicals, and educate students on clean air.
- Parents: Advocate for IAQ at schools, reduce home pollution, and encourage children to report discomfort.

CALL FOR ACTION

Improving IAQ in schools is essential for the health and success of future generations. Simple, effective interventions can transform learning environments into healthier and safer spaces. Collaboration among all stakeholders—administrators, teachers, and parents—is key to achieving this goal.

We Intend to do more in depth studies to understand IAQ conditions and sources of pollutants at various micro-environments.

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