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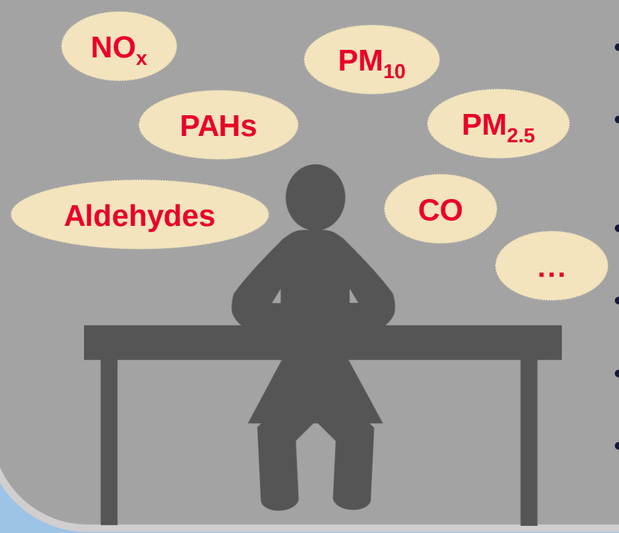
Predicting and Improving Indoor Air Quality in Schools for Extreme Climates

Background & Aims

- Extreme weather events such as heatwaves and bushfires can lead to higher concentrations of indoor air pollutants.
- As a susceptible population, children spend up to 1075 hours indoors in classrooms each year[1].
- Recent research has shown that the air exchange rate in classrooms can be lower than the ANSI/ASHRAE Standard 62 recommended value[2].
- Poor ventilation can exacerbate health problems (e.g., asthma).
- This research aims to investigate indoor air quality (IAQ) and health indicators in educational settings to cope with the increasing incidence of extreme weather.
- This research will also investigate the scope and effectiveness of interventions to improve IAQ and children's health levels.

Health Risks of Indoor Air Pollutions [3,4]



- Double the number of heat-related deaths
- Increased hospitalizations for asthma, pneumonia, and cardiovascular disease
- Increased ozone-related mortality and hospitalizations
- More prevalent Sick Building Syndrome
- Headache, nausea, insomnia, and mood disorders
- Reduced academic performance and cognitive ability

Methods

1 Data Collection

Field Monitoring Data

- Temperature
- Humidity
- PM concentration
- CO2 concentration

Building Parameters

- Envelope structure
- Location
- Ventilation system

Questionnaires

- Health Indicators
- Academic Performance

2 Modeling

Predictive Model

- The relationship between ventilation rates, pollutant concentration levels, and health indicators will be established by neural network algorithms.

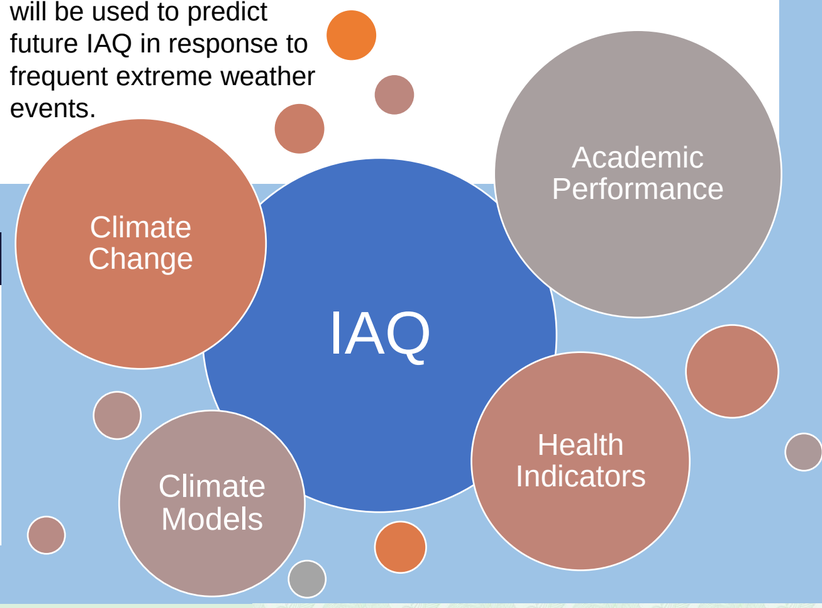
Future Trends

- Various climate models will be used to predict future IAQ in response to frequent extreme weather events.

3 Simulation

Improvement Measures

- Building airtightness
- Demand response ventilation
- Filtration technology and air purification
- Long-term and short-term effectiveness on IAQ and energy consumption.



Expected Results & Impacts

- Outcomes of this research will include models for calculating and predicting IAQ and health indicators.
- Improvement measures and guidelines for improving IAQ and children's health in current and future climate conditions will be presented.

Reference

[1] Department of Education and Training, Victoria. 2017. *School Policy Advisory Guide–- School Hours*. Accessed 14 November 2017.
[2] Rajagopalan P, Andamon MM, Woo J. Year long monitoring of indoor air quality and ventilation in school classrooms in Victoria, Australia. *Architectural Science Review*. **2022**;65(1):1-13.
[3] Fisk, W.J. Review of some effects of climate change on indoor environmental quality and health and associated no-regrets mitigation measures. *Build. Environ.* **2015**, 86, 70–80.
[4] Carrer, P.; Wolkoff, P. Assessment of Indoor Air Quality Problems in Office-Like Environments: Role of Occupational Health Services. *Int. J. Environ. Res. Public Health* **2018**, *15*, 741.

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