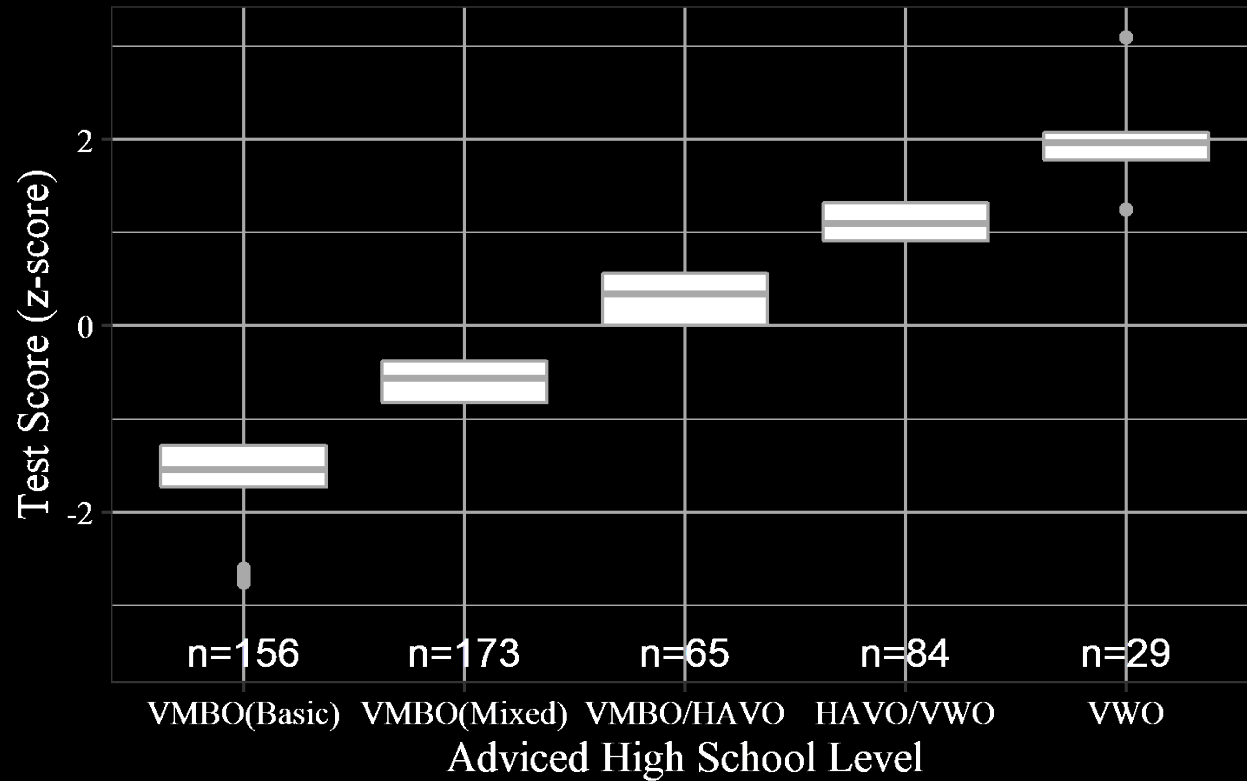




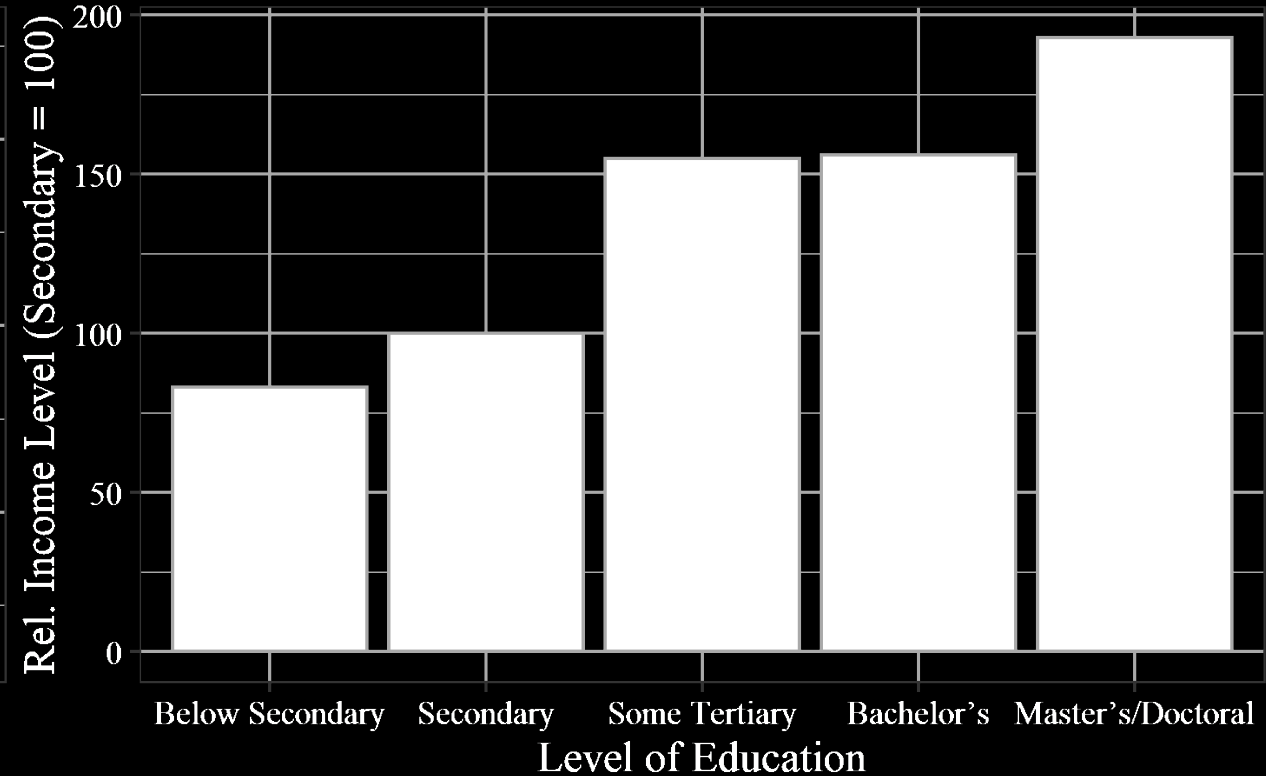
The Importance of Ventilation in Classrooms

Nicolas Duran

Primary Education is Fundamental Everywhere. In the Netherlands, Primary School Tests are Defining.



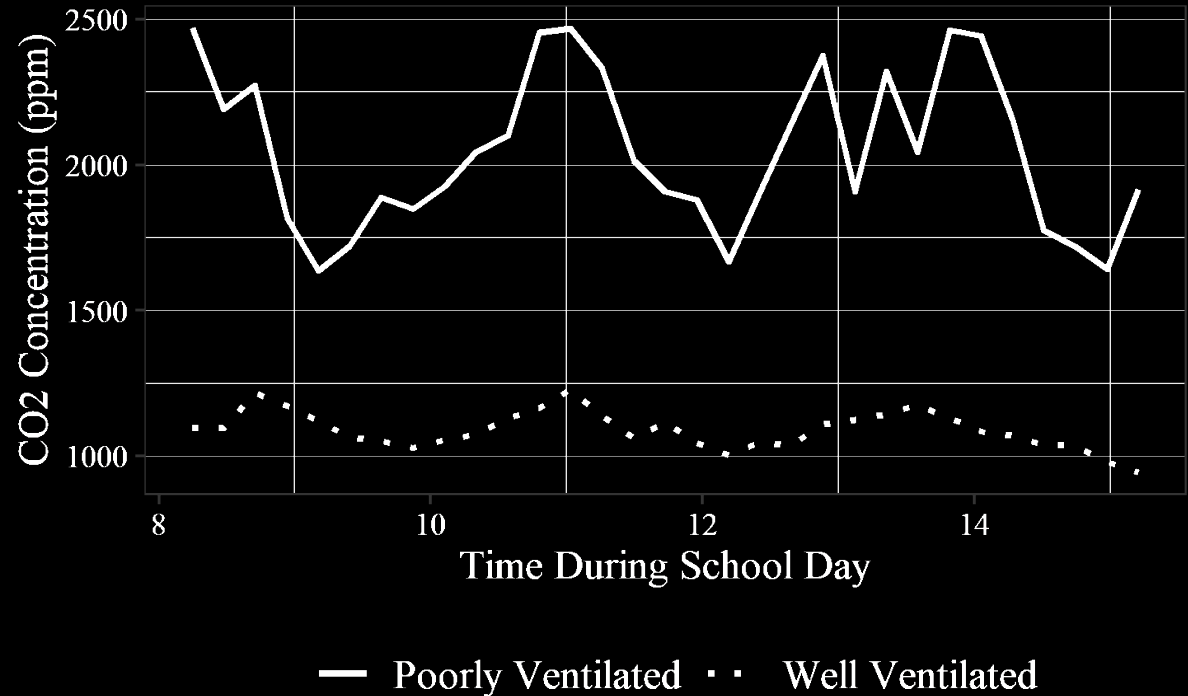
Source: Duran et al. (2022)



Source: OECD

In Terms of Ventilation, There are Good and Bad Classrooms

- There can be stark differences in the ventilation that students are subject to
- During a typical school day CO2 concentrations in a well ventilated classroom oscillate on average around 1000 ppm. In a poorly ventilated classroom CO2 concentration oscillates between 1500 and 2500 ppm.



Source: Duran et al. (2022)

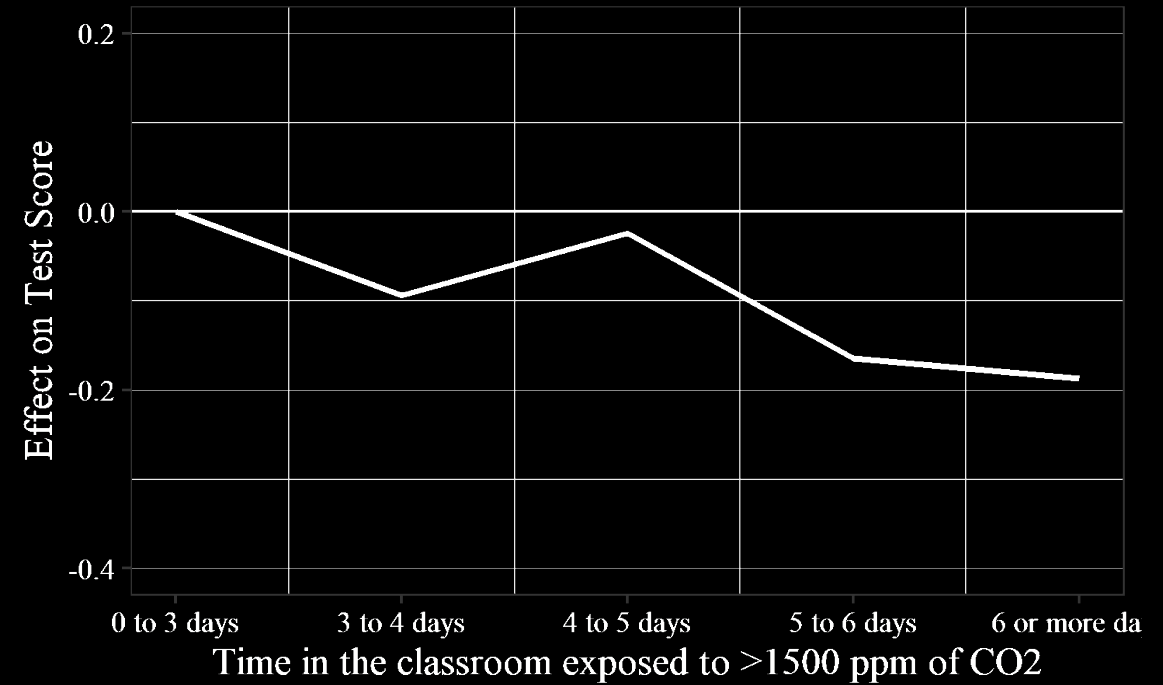
Question: What is the Role of Ventilation In Learning?

- Installed sensors to measure CO₂ concentrations and air quality parameters at very high frequencies in over 230 classrooms of 27 schools in Limburg
- Collected these data over three academic years and obtained the tests scores of the primary school students learning in those classrooms during the same period
- We relate test scores to CO₂ concentration in the classroom where students learned the test subjects

**Answer: turns out, ventilation
plays a fundamental role in
learning outcomes**

Time Exposed to Poor Ventilation and Academic Outcomes

- Children exposed to more than 1500 ppm of CO₂ concentration for more than 3 days while learning will achieve between 10% to 20% worse scores than those exposed for less than 3 days
- For a number of students, this underperformance can be one of the reasons for perceiving 50% to 100% less income in adulthood than otherwise



Source: Duran et al. (2022)

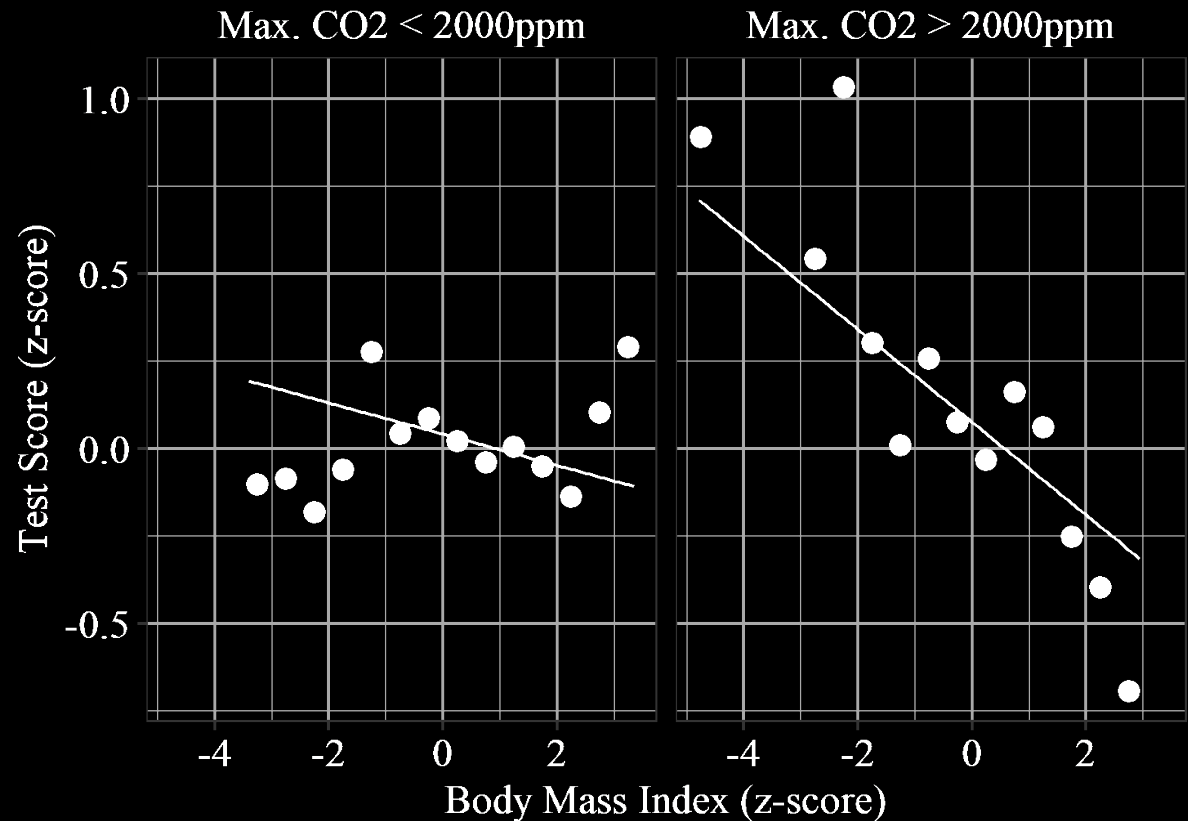
Solutions come with trade-offs

- Use ventilation at maximum power → Energy consumption
- Allow windows to open → Outdoors pollution transfer and reduced temperature comfort (energy consumption)
- Invest in modern ventilation and filtration systems → As we insulate our buildings, we need to understand the impacts on health and productivity of indoors sourced pollution (moulds, dust, VOCs)

What's next?

BMI and Test Scores: the Mediating Role of Ventilation

- Children with higher BMI achieve lower academic outcomes on average
- Do poorly ventilated classrooms intensify this disparity?



Thank you!

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