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Ventilation rates in schools and pupils' performance

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Abstract

This paper is a development of our earlier work [5], [6], [11]. The effects of classroom ventilation on pupils' performance were investigated in 8 primary schools in England. In each school the concentrations of carbon dioxide and other parameters were monitored for three weeks in two selected classrooms. In 16 classrooms interventions were made to improve the ventilation rate and maintain the temperature within an acceptable range using a purpose-built portable mechanical ventilation system. As a result of the interventions the provision of outdoor air to the classrooms was improved from the prevailing levels of about 1 l/s per person to about 8 l/s per person.

The pupils and teachers in the classrooms studied were usually exposed to unacceptably poor air quality conditions, with CO₂ concentrations of up to 5000 ppm, much higher than the average recommended levels of 1500 ppm and the preferred level of 1000 ppm.

The results of computerized performance tasks performed by more than 200 pupils showed significantly faster and more accurate responses for Choice Reaction (by 2.2%), Colour Word Vigilance (by 2.7%), Picture Memory (by 8%) and Word Recognition (by 15%) at the higher ventilation rates compared with the low ventilation conditions.

The present investigation provides strong evidence that low ventilation rates in classrooms significantly reduce pupils' attention and vigilance, and negatively affect memory and concentration. The physical environment therefore affects teaching and learning.

Highlights

• Level of CO₂ affects cognitive performance. • Test data collected from 8 UK primary schools. • Recommended ventilation rates are proposed. • Teachers participated and provided case history evidence for further recommendations for designers.



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Keywords

Schools; Ventilation rates; CO₂; Environmental effects on learning; Pupils' performance

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