

Impact of Indoor Air Quality on Cognitive Function in Green Buildings

Usha Satish, Psychiatry and Behavioral Sciences, SUNY-Upstate Medical University,

Suresh Santanam, Biomedical and Chemical Engineering, Syracuse University,

Joseph Allen, Piers MacNaughton and John Spengler, Environmental Health, Harvard University

ABSTRACT

Since many of the workers in our current economy hold jobs that require them to work in an office setting on a daily basis, the impact on their productivity due to subtle changes in indoor air quality (IAQ), may have substantial impact on performance and economic outcomes for their employers. In this research work, conducted at the advanced Total Indoor Environmental Quality (TIEQ) Labs at the SyracuseCoE building, researchers measured various cognitive functions of a cohort of 24 participants over a two-week period. In this double-blind study, IAQ conditions at the TIEQ Labs were simulated to represent a conventional office environment, and two improved IAQ conditions representing a green building and an enhanced green (green+) building, respectively. Cognitive performance scores for the participants who worked in the green+ environments were, on average, double those of participants who worked in conventional environments; scores for those working in green environments were 61% higher. Measuring nine cognitive function domains, researchers found that the largest improvements occurred in the areas of:

- Crisis response (97% higher scores in green conditions and 131% higher in green+)
- Strategy (183% and 288% higher)
- Information usage (172% and 299% higher)

In addition, when researchers looked at the effect of CO₂—not normally thought of as a direct indoor pollutant—they found that, for seven of the nine cognitive functions tested, average scores decreased as CO₂ levels increased to levels commonly observed in many indoor environments.

BIOGRAPHY

Joseph G. Allen, DSc, MPH, Assistant Professor of Exposure Assessment Science, Director of the Healthy Buildings Program at the Center for Health and the Global Environment at Harvard T. H. Chan School of Public Health

Piers MacNaughton, MS, doctoral candidate, Harvard T. H. Chan School of Public Health

Usha Satish, PhD, Professor, Department of Psychiatry and Behavioral Sciences, SUNY Upstate Medical University

Suresh Santanam, ScD, PE., Associate Professor of Biomedical and Chemical Engineering, College of Engineering and Computer Science, Syracuse University

Jack Spengler, PhD, Akira Yamaguchi Professor of Environmental Health and Human Habitation, Director of the Center for Health and the Global Environment, Harvard T. H. Chan School of Public Health