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**PRESENTER ABSTRACTS**  
ACADEMY OF NEUROSCIENCE FOR ARCHITECTURE

# The Inter-Related Relationship Between Thermal Comfort, Indoor Air Quality and Students' Cognitive Performance in the Built Environment

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## 1. ABSTRACT

By focusing on the occupants' health as an endpoint and how various implications for human cognitive performance are attributed to poor buildings' design, this study is aiming to investigate the impact of thermal comfort, indoors' ambient temperature and CO<sub>2</sub> concentration as an indicator for indoor air quality on students' cognitive performance in educational buildings where students spend significant amount of their time. Saudi Arabia has been chosen as a case study, with reference to hot arid climates where scarce data is available. The results of a pilot study conducted on 30 female subjects in a female collage in Saudi Arabia will be presented; in which both quantitative and qualitative methods were employed, namely: monitoring classrooms' CO<sub>2</sub> levels, air speed, relative humidity, light intensity and sound levels, along with measuring students' activity, clothing level and cognitive performance. Eight tasks of BARS (Behavioural Assessment and Research System) neurobehavioral tests<sup>1</sup> were used to evaluate the students' cognitive performance. Also, thermal comfort votes were collected via self-administrated questionnaires. Students' cognitive performance was measured by a cognitive testing battery. The main scope of the experiment design has been based on repeating the cognitive tests under three different temperatures (20, 23 and 25°C). In the intervention classrooms, the concentrations of CO<sub>2</sub> were maintained at a pre-set level of 1200 ppm, achieved by a constant volume central air conditioning system. Repeated measures ANOVA pairwise comparisons indicate statistically significant results in almost all tasks. The speed of hands is yet evident to be impaired due to cool exposures, in line with the results of recently relevant published findings. Accuracy of memory tasks was found to be impaired at 25°C and 23°C, the reported comfortable condition, compared to the cold exposure 20°C, concurrent with the slowest response time. Accuracy of attention tasks peaked at 20 and 23°C compared to 25°C. Coordination tasks showed some discrepancy among the reversal typing and reversal learning test results which could be attributed to the few number of participants and thus further investigation is needed. Outcomes of the study can be used to reflect how much learning disability could be realistically avoided every year as a result of better educational buildings' design. The study will contribute to the development of creating environments conducive to learning as well as enhancing Thermal Comfort and IAQ guide lines for educational buildings' design.

**Keywords:** Thermal Comfort, Indoor Air Quality, Cognitive Performance, Built Environment

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1. <http://www.nweta.com/bars/>

