

How indoor environment quality affected college students' mental health and learning performance during COVID-19: a long-term study

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INTRODUCTION

During COVID-19 pandemic, people's lifestyles have been changed dramatically and an increase of depression among young adults has been observed [1]. Most universities or colleges offered online courses instead to prevent COVID transmission. Typically, home environment is not designed for work or learning. Despite that the relationships between indoor environment quality (IEQ) and people's physical health and work performance have been investigated in regular time [2], very few efforts have been taken to understand the relationship between IEQ and students' mental health and learning performance during COVID-19 when mental health and learning have become more crucial due to the face-to-face classes suspension, stay-at-home policies. The research gap exists on how IEQ at home or similar residential buildings is related to mental health and learning. This work aims to 1) understand how indoor environmental (such as thermal, air quality, lighting, acoustic) satisfaction is related to college students' mental health and learning performance, and 2) predict depression with IEQ satisfaction.

METHODS

We have enrolled 140 college students from 15th, 2020 to May 26th, 2021 and asked them to report periodically stress, positive and negative emotion, loneliness, depression, IEQ satisfaction, and self-reported learning performance. Besides the calculated correlations between IEQ satisfaction and mental status, a logistic regression model has been built to predict depression. Ten-fold cross validation and the area under receiver operating characteristic curve (AUC) were applied to test the model quality. The statistical significance was based on $p < 0.05$ (*), $p < 0.01$ (**), and $p < 0.001$ (***)

PRELIMINARY RESULTS AND DISCUSSION

The preliminary analysis shows that student's mental health is weakly (but not negligibly) correlated with the satisfaction with the light amount, acoustic, overall IEQ, and visual comfort based on the calculated *Pearson's* correlations (Figure 1), while learning performance is weakly (but not negligibly) correlated with the satisfaction of the thermal, indoor air quality (IAQ), light amount, and acoustic, and visual comfort. The overall IEQ satisfaction is mildly correlated with learning performance, indicating the importance of IEQ during remote learning.

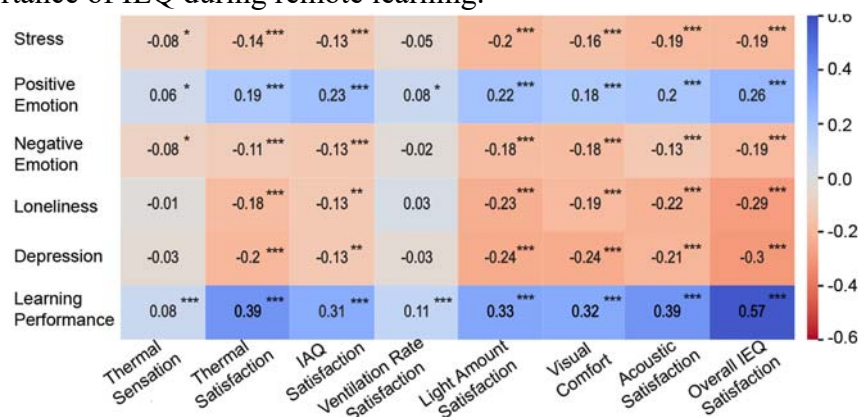


Figure 1. Correlation between IEQ satisfaction and students' mental health, and self-reported learning performance. |0-0.2| (negligible or very weak correlation); |0.2-0.4| (weak correlation); |0.4-0.6| (mild correlation).

Students' depression is determined by center for epidemiological studies depression (CESD) survey. A cutoff score of 10 or higher indicates the presence of depressive symptoms [3]. We built a logistic regression model to predict students' depression based on IEQ satisfaction. In this model, visual comfort and overall IEQ satisfaction are significant variables and the average AUC is 0.67.

CONCLUSIONS

Most IEQ satisfactions have statistically significant but weakly negative correlation with mental health status while weakly or mildly correlated with learning performance. Students' IEQ satisfaction can be used to predict their depression.

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