Methodology for the evaluation of Indoor Quality and comfort in schools' classrooms

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OVERVIEW OF THE PROJECT

Research on Indoor Environmental Quality in schools usually refers to one or two aspects of the four (thermal, acoustic, visual and air quality), even the most recent research deals with these topics separately without considering all the factors that influence the environmental quality of the spaces. This research proposes a methodology to evaluate the indoor conditions in classrooms through surveys and measurements and presents a first approximation to an index to evaluate IEQ in an integrated way.

1. CONTEXT

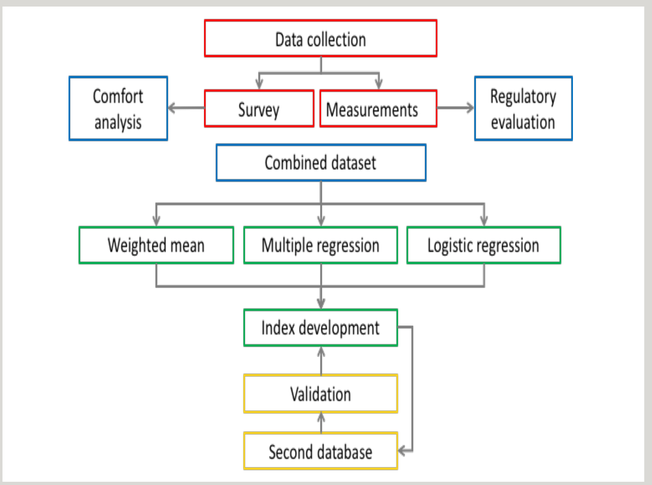
The low the environmental quality (IEQ) of educational spaces has a negative effects on student's welfare and learning outcomes. To define a comfortable space, it is necessary to state a methodology to assess IEQ for students and teachers in school classrooms, considering the four aspects that define IEQ: Thermal comfort, Indoor air quality, visual comfort, acoustic comfort in an integrated manner, to then define standards that are verifiable, considering time of exposure that can ensure an educational space that delivers comfort to its occupants.

1. OBJECTIVES

Develop an indicator weighting the relevance of the four aspects of IEQ, with respect to the general comfort of students in school classrooms, allowing the evaluation and comparison of the quality of the spaces.

1. Determine the relationships between the thermal, acoustic, light and air quality parameters, and delineate an index.
2. Evaluate the environmental conditions and the perception of the environmental comfort of the students in educational establishments to weight the relevance of each parameter on the index.
3. Design a methodology that allows to weight in a single index the environmental factors to predict environmental comfort.
4. Define the indoor environmental conditions under which students will be forgiving of the IEQ.

2. METHODOLOGY

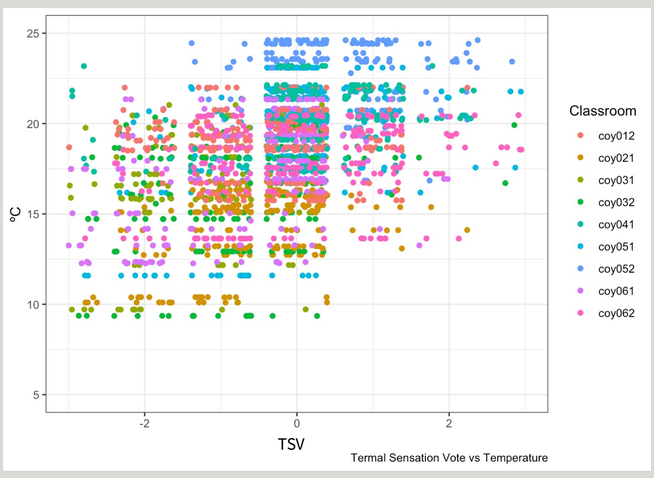


301 students were surveyed in 12 class-rooms located in the city of Coyhaique, in the south of Chile. The survey design was longitudinal, were each student answered the survey between 1 and 15 times depending on their assistance in the 5 days studied.
Measurements were preformed during the time and date of survey. The combined dataset was then analysed using Weighted mean, multiple regression and Binary Logistic Regression Analysis (BLR).
Afterwards , and based on the results of the statistical analysis, an index was developed.

3. RESULTS

To evaluate if there is a relationship between categorical groups and TSV, Chi-square was computed, as well as Cramer's v.

- Outdoor temperature had no relation with thermal comfort.
- Indoor temperature was related with thermal comfort, but with a low association.
- CO_2 concentration was related with thermal comfort, but with no association.
- Clo was related with thermal comfort , but with little association.



4. LIMITATIONS

The main limitation of this work is the quality of the gathered data. Real-world external events, prevented the researcher to access classrooms and gathering data that would have enriched the index. However, the amount of data available sufficed to develop a methodology.

Similar studies worked with similar /smaller samples, with data size between 50 and 65 self-reports per test subject. This ensures the representativeness of this study in the context of less studied regions of the world.

The initial results indicate that it would be interesting to further develop this index, to include measurement for acoustics and illumination.

Particulate Matters in outdoor air should also be considered for Coyhaique further research should also measure it inside the buildings. Since the buildings only had natural ventilation, contaminated air can be assumed based on outdoor conditions.

DISCUSSION

1. When classrooms are heated, there is no relationship with outdoor temperature as outdoor temperatures were very low (-5.2 to 9.3°C)
2. Students thermal comfort for this case studies does not correspond with previous calculations for Chile (Trebilcock, 2017)
3. Other parameters such as air quality, light and acoustics need to be further studied.

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