CONFORT AREA FOR AN IMPROVED LEARNING PROCESS IN HOT ENVIRONMENT

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ABSTRACT

Overall, it is known that temperature influence the students’ learning skills. In this essay, thermal-higrometrical parameters that influence the well-being of students and the building of their knowledge are valued. A thermal index is applied to the registered data. It is valued the real thermal sensation of each student by a seventh colour scale. Results show unequivocally that a thermal environment influences the learning results.

Keywords: learning process, thermal indexes, EsConTer, PPD, hot thermal environment.

INTRODUCTION

Nowadays, when speaking of knowledge development and teaching and learning processes it should be considered important aspects related to motivation, middle stimuli (surroundings of the person), social relations and the education received, among others (Coll, Palacios & Marchesi, 1995). Separating the phenomenon of education as something essentially social and highlighting the educational practices found in formal education can be seen a constant concern with elements, new and old, that interfere directly and indirectly in this phenomenon. One of these factors relates to the learning environment, its organization and the variables that may influence positively and negatively the learning process.

As so, it is important to clarify the concept of thermal comfort, then, it is defined as "a state of mind that reflects satisfaction with the thermal environment surrounding the person". Thus, it is understood that the thermal sensation is related from individual to individual and depends also on the metabolism of each person (ISO 7730, 2005).

Thermal comfort is directly linked to nine variables that represent an important part of well-being and satisfaction of students in need of healthy school environments. These variables are noise, light, temperature, relative humidity, air purity, air velocity, radiation, physical activity and type of ventilation (Lula & Silva, 2002).

Santos, Coutinho & Araújo (2002) report that it is easy to see that a learning environment must suit the comfort of the students, so that they can maintain a certain balance, whether it is physical or mental, without the effort of adaptation.

It is known that the concern surrounding the thermal performance in public schools has fallen short, without being detailed or even being despised. For the majority of school buildings, architectural features are more or less standardized construction systems, created in the same way across the country, with the same building design, without taking in account the weather or the climate.
All these factors combined give the majority of public school buildings a space that does not meet the basic needs of comfort. Certainly, these conditions affect negatively the motivation and concentration of students. Thus, it is necessary that architecture takes into account the needs of thermal comfort, to provide a pleasant and conducive teaching and learning process (Nogueira & Nogueira, 2003)

Wyon (2010) related the thermal comfort with the teaching and learning process and presented data recorded in two schools classroom in Denmark, involving about 300 students, which show a decrease of the evaluation results of 3.5% of per °C of temperature rise inside the classroom.

Rebelo, Santos, Batista & Diogo (2008) showed that the thermal environment in classrooms affects the learning process despite the levels of education. The authors showed the strong influence of solar radiation throughout the day in comfortable conditions in classrooms, this study points out that the thermal discomfort is usually one of the biggest complaints from other factors that create the environmental comfort.

For all that has been described, this work is to show how a hot thermal environment around students affects their learning process.

**METHODOLOGY ADOPTED**

This study analysed the reviews of a group of students in accordance with the actual thermal sensation and thermal sensation provided in the classroom during different days of warm thermal environment in which they used a question problem at the end of class time.

The period considered was from 14th of May until 5th of June of 2013. The air temperature and relative humidity were recorded using simple tools and built by students, as shown in Figure 1.

To determine the real thermal sensation of the students it was used a colour scale, where students when responding to the questions, would choose between comfort zone and discomfort zone feeling at that precise moment. After correcting the answers of each student, it was recorded the real thermal sensations in the colour scale and, later on, converted to ISO 7730 scale (2005), as shown in Figure 2.
Fig. 2 - Colour scale and EsConTer index presented in the classroom.

The planned thermal sensation was calculated using the EsConTer index developed by Talaia & Simões (2009).

RESULTS

From Figure 3 to Figure 7, it is presented a series of pictures of the evaluation results of students in a study group, regarding the thermal sensations given by students at the time of the assessments.

The group of students is called Bi, with i indicating the number of students.

On the ordinate (left), it is given the evaluation, Evaluation_j, with j indicating the sequence of evaluations carried out and represented with columns.

On the ordinate (right), it is identified the actual thermal sensation of the student, indicated by the student at the time of the day of the issue, in a thermal process colour, and represented by the broken line.

The horizontal line indicates, according to the temperature and relative humidity of the air inside the registered classroom, the expected thermal sensations.

Observing the pictures and each Evaluation_j, the results obtained by the students show unequivocally that the thermal sensation influences the evaluation results.

Fig. 3 - Evaluation _1 line with the real and predicted thermal sensations (hot thermal environment).
Fig. 4 - Evaluation 2 line with the real and predicted thermal sensations (hot thermal environment).

Fig. 5 - Evaluation 3 line with the real and predicted thermal sensations (hot thermal environment).

Fig. 6 - Evaluation 4 line with the real and predicted thermal sensations (hot thermal environment).
As shown in Figures 3 to 7, when the thermal sensation experienced by students located in the comfort zone, -0.5 to +0.5, the results tend to be positive in the general register values above 50% (Out 100%).

When the thermal sensation experienced by students is greater than +0.5, the evaluation results are affected inversely, and decrease in general register values below 50%. The results also show that when the thermal environment recorded wind chill values experienced above +0.5, student outcomes decrease. For slightly environment "hot" (+1.0) the "hot" (+2.0) results in general are less than 50% (out 100%). The values of thermal sensation felt by the students are in agreement with the values of the thermal sensation provided by EsConTer index.

Then, we present Figures 8 to 12 shows that, for some students, the evolution of ratings when the thermal environment is changed, for the days considered "hot".

Fig. 8 - Reviews of the student_B1 line with the real thermal sensation and provided (hot thermal environment).
Fig. 9 - Reviews of the student_B3 line with the real thermal sensation and provided (hot thermal environment).

Fig. 10 - Reviews of the student_B5 line with the real thermal sensation and provided (hot thermal environment).

Fig. 11 - Reviews of the student_B7 line with the real thermal sensation and provided (hot thermal environment).
Observing figures 8 to 12, it can be stated with even more certainty that when the thermal sensation felt by students is greater than +0.5 results tend to be negative. When the environment is slightly characteristics of "warm" (+1.0) the "hot" (+2.0), results are very negative.

Based on the presented assumptions and based on the results obtained, it is clear that the assessment of pupils is largely determined by the thermal sensation felt by students, thus it can be concluded that the learning process is affected by the ambient thermal conditions around them students.

Finally, it is noted that in the evaluations assessed the contents were taught in class the day of evaluation, which stresses that, in most cases, students were not in thermal comfort for the acquisition of knowledge.

CONCLUSION
The results show that the thermal conditions of a classroom may influence the learning process.

From the obtained data analysis, it can be stated that the results allowed us to know the feelings of comfort and discomfort of the students and how these affect learning and evaluating the construction of knowledge.

The results show unequivocally that the method used is an important tool to assess how thermal discomfort situations may affect the learning process.

In the current issue of climate change, global warming is accepted, such studies are important in order to be evaluated as the thermal environment influences the learning process.

REFERENCES


