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Effect of Acoustic and Thermal Comfort to Support Learning Process in a University

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Abstract

Teaching and learning activities are the main part of success in implementing education at university. However, the existing condition of indoor acoustic and indoor thermal are factors that disrupt both to students and to lecturer in the classroom. This paper presents a study regarding effect of indoor acoustic and thermal towards comfort of students in classroom. The type of classroom involved in this study was based on their partition that used for separate the adjacent classroom, namely tacon partition (C1 room) and brick partition (C2 room). The phases of the study were consisted of two parts of the investigation where the first part was to measure the indoor acoustic to model its distribution and also measure indoor thermal to obtain the existing value. Additionally, the second phase is accomplished by distributing questionnaires simultaneously during the measurement period. Subsequently, the following part is to model the condition of indoor acoustic by using Surfer software v. 11. The findings indicate that the C1 room having intensity of noise within the range of 56.5-68.5 dBA while the C2 room having intensity of noise within the range of 62-96 dBA and it need to be insulated. In addition, the noise intensity doesn't meet the acoustical criteria for educational purpose, which is 55 dBA. However, the questionnaire results show that the respondents are feel comfort with the existing noise intensity level in those two rooms. Thus, it can be concluded that the comfort is a perception that is built in a everybody's mind and it can't be determined directly by threshold value. This study suggests that psychosocial aspect is also an important aspect that needs to be considered for an experiment which involves human behaviour. Finally, these two approaches between direct measurement and questionnaire survey give an useful perspective for building designer to design a building which is not only improve the building performance but also fulfils the needed of the building's occupants.

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1. Introduction

Education is a process of learning and teaching with the aim of improving the quality of human resources. This is happening in an environment such as schools, colleges, and libraries. However, the educational process can be hampered if it located in noisy area.

The sound is a phenomenon which we cannot avoid in daily life, including workplaces and other activities. However, the occurrence of noise is frequently disrupt daily activities such as teaching and studying which takes place in university. That disruption is usually contributed from a high-frequency noise which risk to damage one's hearing and it will be bad for the human body if exposed at certain duration [1,2].

In addition, for supporting learning process, there are two requirements that students can listen well. The first is the condition of neighbourhood that is not noisy. Noise can come from the traffic on the road, the activity around the school, the sound of the next class, and the noise from the air conditioning system. The second is a low reverberation time, which is a parameter that indicates how fast the noise will disappear. The higher the reverberation time, it will be longer sound that survive indoors [3,4].

Subsequently, comfort in the classroom is not only by the noise, but the conditions of temperature and humidity of the room also affect the occupants of the room. The quality of the room environments serve as an assessment criteria that can be accepted

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by the occupants of the room or office environment [5]. Thermal environment representation regarding to temperature and humidity can be felt as heat, cold, damp or dry [6].

In Indonesia, the awareness to provide comfort environment in term of acoustic and thermal effects are less of concern. This condition had motivated authors to study regarding effect of acoustic and thermal comfort to support learning process in a university.

2. The object of the study

Measurements were carried out at classroom that partitioned with tacon (C1) and brick (C2) as displayed in Figure 1 and Figure 2 consecutively. Additionally, the C1 room have no carpet in its floor while the C2 room have carpet. The most obvious difference from these two classroom are the orientation of the C2 classroom that protrudes downward.

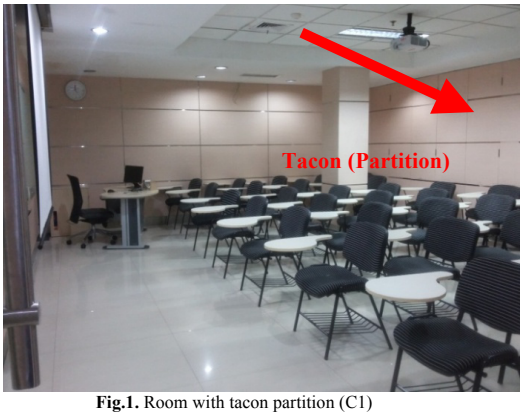

Fig.1. Room with tacon partition (C1)

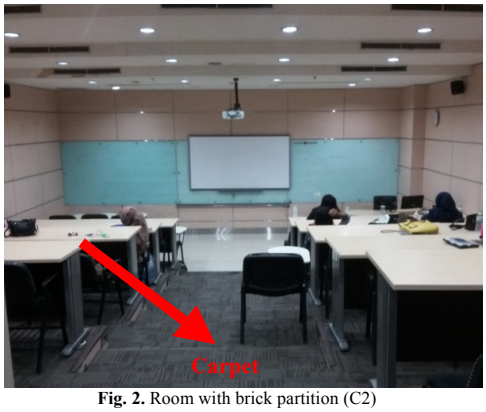

Fig. 2. Room with brick partition (C2)

3. Methods

3.1 Equipments

The measurement was conducted during activities of teaching and learning within a day. The intensity of noise was measured by sound level meter (SLM) whereas thermal condition was recorded by using hygrometer. These two equipments are visualised as in Figures 3 and 4 successively.

Fig. 3. Sound Level Meter

Fig. 4. Hygrometer

The SLM device have two modes of measurement in which for A mode the measurement of noise intensity is starting from 30-130 dBA whereas for C mode is starting from 35–130 dBA. The accuracy of this device is ±1.5 dB with the ability to measure the temperature within the range of -50 ºC to 50 ºC. During measurement period, these two devices are located 1 meter from floor by using a tripod. Additionally, to depict the real location of SLM and Hygrometer when the measurement was conducted then the sketch of measurement points is visualised as in Figures 5 and 6 successively.