

# ACCEPTABLE ILLUMINANCE LEVEL ATTRIBUTES TO LEARNING SATISFACTION IN CLASSROOM

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**Abstract** - The importance of student's satisfaction in school is to highlight the parameter that related to physical of buildings and learning area. Natural lighting is important to human where the daylight shall cause visual discomfort and performance in classrooms. Due to address the issue, the acceptable illuminance level is needing to be identified to increase performance in occupants' satisfaction. Illuminance level in learning spaces should not be neglected where in the form of human values, comfort and culture are to be focused as a main criterion in student's performance. Daylighting in an educational space can be improved in order to enhance the student's performance and promotes a better health and performance due to suitable level of visual comfort. The aim of this study is to investigate the student's performance in classroom with minimum performance zone in minimum Window-to-Wall Ratio (WWR). The physical conditions; WWR of less than 25%, to 40% of typical of classroom and illuminance level that ranged from 300-400 lux were identified to be sufficient daylight level. Pilot studies have been conducted in typical classroom of Kolej Permata Insan where the effects of acceptable illuminance level that contribute to visual performance is identified. Qualitative survey has been conducted on the student's perception toward visual comfort and obtaining the comparison on performance from visual test. The illuminance level for the classroom was recorded using an LED data logger. Findings from the case study showed less than 20% openings in classrooms affect students minimum acceptable of illuminance level. There will significant contrast between internal luminance to external luminance if WWR is more than 70%. While the ideal WWR for classroom should be not more than 40% to achieve the optimum performance zone and acceptable illuminance level. The findings contribute towards the identification of an acceptable visual comfort ranges for students and design recommendations for optimum performance zone in a classroom in Malaysia.

**Keywords** - Keywords-visual comfort, acceptable illuminance level, performance zone, daylighting, classroom.

## I. INTRODUCTION

Throughout the history of learning space design, especially in 19th century, the evolution of the space influenced by a few variables such as construction technology, government's policies, educational systems and many others. The design started with a single room building where the students are in one house and learns in a typical educational system, the term introduced by Robson (1874) was 'School House' [1]. After the years, integration of learning spaces with a larger institutional body with larger accommodations starts to become more viable due to increment of number of students in a classroom.

Usually the classrooms will be held in a large open plan area such as church's hall and community hall. Afterwards, typical modern schools are designed, which have a few classrooms in a single building that also caters for different education. The typical design changed when the educational system starts to change from students learning in one huge space into a smaller group of students [1].

## II. LITERATURE REVIEW

### 2.1 Student's Performance

Efficient illuminance level through optimum daylighting in learning space can affect student's performance [2, 3, 4]. According to Hescong, a

statistic investigation of standardized test scores of students shows that daylighting influences human behavior as well [2]. Mirrahimi stated that the student's health and performance can be increased by providing a sufficient natural lighting [4].

Shishegar stated that the student's alertness, cognitive performance, attention span and moods in classroom can be improved by optimizing natural lighting [5]. Al-Sallal through his findings in a classroom in United Arab Emirates (UAE) stated that the depth of the influence the daylight distribution [6]. Even though the Window-to-Floor Ratio (WFR) exceeds 20%, the daylight distribution is not acceptable due to the large depth of the classroom's layout design. According to Ibrahim, a sustainable element such as daylighting in classrooms can increase the student's performance if it is operated sustainably [7]. A study by Vi Le in a green school shows that the classrooms received mean illuminance level above recommended of 300lux, thus acceptable for teaching and learning [8]. According to Samani, inadequate illuminance level in classrooms resulted in sleepiness and loss of focus among the students [3].

### 2.2 Ranges of Preferred Illuminance Level and Discomfort Glare

Currently the range of preferred illuminance level in Malaysia is not well address especially for students with visual discomfort. Currently the guideline only