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# LIGHTING EFFICIENCY AND EFFECTS ON HUMAN ACTIVITIES IN LIBRARY AT UNIVERSITI TEKNOLOGI PETRONAS

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## **Abstract:**

The aim of this study is to show that proper lighting is crucial for the users to improve their performance and quality of time spent in library. Good lighting design in library buildings is the result of both technical skill and art on the part of the designer. The following study discusses the most important issues in daylighting design for modern libraries. It is not an instruction manual on how to light a library, but it sets specific criteria that, if met, will avoid major mistakes. These criteria also can be used as a checklist for assessing the lighting in an existing library to see if improvements are needed. The quality of lighting really gives a big impact to human behavior and this study of the lighting will give additional proof that human behavior is actually affected by the lighting in the library. In conclusion, the more appropriate the lighting, the more effective will the activities in the library be.

**Keywords:** Daylighting, Human Behavior, Performance, Lighting Design, and Lighting requirements.

## **1.0 INTRODUCTION**

The issue of lighting in libraries is one that is still discussed and debated today. Most of the designs in building nowadays lack effective daylighting concept which will affect the occupants. Daylight is important for the interior space of a building especially to the occupants of the building itself. Efficient and correct daylighting makes patrons feel good and comfortable in their surrounding while bad, excessive or insufficient daylighting creates problems for patrons and affect their activities in the library. For example, if the lighting is bad when looking through stacks of book, patrons may keep their visit to the library short. The lighting can even have a negative impact on the staff, who work there. The lighting affects the productivity of staff, especially if the lighting creates glare and heavy shadows. Apart from that, the library, with incorrect lighting would also not be welcoming to visitors.

## **2.0 LITERATURE REVIEW**

The published literature reviewed for this paper provides an understanding of daylighting in a library and its effects on human behavior and perceptions. In addition, the understanding of design for daylight is defined as the amount of daylight penetrating the library's interior and how this natural light impacts the space. The successful daylighting is summed up to be the understanding of the characteristics of daylight as well as how design controls the light to prevent any lighting failure such as glare or heavy shadows. These will ensure that the library is comfortable for humans.

### **2.1 Daylighting**

According to Hasirci (2011), the occupant's behavior and perception is much affected by daylight because daylight is a controlled architectural tool. However, daylight can also affect the time spent by increasing the quality and how long someone will stay in a space. Apart from that, daylighting is crucial to student communities in order to improve their performance.

### 3.0 METHODOLOGY

Several methods have been used so that all the necessary data are ready and able to be analyzed. The research approach for this study is quantitative. One of the well-known libraries in Perak, which is the Library of Universiti Teknologi Petronas designed by Architect Norman Foster was chosen as a case study. The data analysis was determined from the result of lux measurement and the questionnaires replied by the library users besides observation around the library. With the data collections and observation, the hypothesis of the study on how efficient sunlight actually influenced the occupants of the buildings could be done. In this section, the strategy and method utilized as a part of gathering information, will be elucidated and used to explain all the necessary data.

### 4.0 ANALYSIS AND FINDINGS

The quantitative method of recording data by utilizing an appropriate and suitable instrument is used in order to gain a precise data. The instrument used is a lux meter, which is placed at the different zones along the opening of the library and the lux reading will be recorded at (3) different hours. The qualitative method of interview and observation is used in order to get supporting data for this study. Based on the interview and questionnaire to the respondents, a few data were obtained about factors that contribute to daylighting which affected the time they spent in the library and their seating options. To support the data obtained from the respondents, surrounding activities and architectural factors have also been observed at the library.

Table 1: Data of Lux Reading by Zone

ZONE	9 AM			12 PM			3 PM		
	Min Lux	Max Lux	Average	Min Lux	Max Lux	Average	Min Lux	Max Lux	Average
A	320	337	328.5	449	472	460.5	543	596	569.5
B	418	457	437.5	586	592	589	609	621	615
C	492	541	516.5	601	649	625	692	724	708
D	623	659	641	753	797	775	750	795	772.5
E	741	803	772	872	893	882.5	811	834	822.5
F	859	893	876	903	939	921	884	892	888
G	925	997	961	1011	1097	1054	912	937	924.5

The above table shows the lux reading in different zones at 3 different interval hours. The purpose of the average values obtained is to compare the differences of lux received in each zone that had been divided accordingly. Apart from that, the difference of lux reading in each zone is due to the building orientation that distinguishes sunlight acceptance to the interior spaces of the library. In addition, to study daylight at the library in a more specific manner, the data were recorded at 3 different hours of the day as the variability of sunlight are different in the morning, afternoon and evening. Therefore, by recording the data at 3 different hours, the amount of daylight received and how it affected the occupants could be analyzed in greater detail.

### 5.0 CONCLUSION

From the study it is found that successful daylighting will give the positive effects to the occupants in the building. Besides, the understanding of designing natural lighting concept, material selection, sunlight control design, space planning and other factors that contribute to daylighting design were also gained from this research. As a conclusion, the study helps to give an indication of the library's user preferences and performance regarding to daylight availability. Hence, this paper provides future designers insights on how to design better and provide efficient lighting, seating layout and any other design related to daylighting in the library. This solution will improve the quality of the overall library's function.

**REFERENCES**

Hasirci, D. K. K. (2011). Daylighting Concepts for University Libraries and Their Influences on Users' Satisfaction. *The Journal of Academic Librarianship*, 37(6), pp. 471-479.