

UNIVERSITI TEKNOLOGI MARA

**THE DETERMINATION OF
DAYLIGHTING DESIGN FAILURE
FACTORS IN EDUCATIONAL
BUILDINGS**

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MSc

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.


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ABSTRACT

The idea of natural lighting is to provide daylighting to the building area. Daylight is determined by the local climate and is influenced by factors, such as orientation, building surroundings, and location, during the first stage of building construction. Implementing natural light design to a building is challenging, and educational buildings involve optimal lighting conditions. There is a significant expense pressure as most educational buildings use high lighting energy due to occupants' daily working hours usage. This research investigates the daylighting design failures in existing educational buildings at UiTM Perak. Daylighting design failure occurs when it wastes the capability to achieve its intended function. Therefore, this research aims to determine the actual illuminance level in the studied classrooms to ensure that existing classrooms have insufficient indoor daylight and identify different classroom characteristics contributing to daylighting design failures. At the end of this research, it focuses on recommending the best daylighting design solutions for classroom spaces. This research employed a quantitative method, a fieldwork measurement and classroom characterisation observation as the research methodology. Thus, a series of fieldwork measurements were performed in the studied classrooms for five (5) days to determine the classroom's actual illuminance level. This research measured indoor and outdoor lighting levels to evaluate the classrooms' daylighting levels in different building forms. Hence, the Systematic Literature Review (SLR) method was used to identify factors contributing to inefficient daylighting design in studied classrooms. Six (6) factors affect daylighting performance, and those factors were used to conduct an observation. Fieldwork evaluation revealed that two out of three studied classrooms did not achieve the indoor illuminance level as stated in MS1525:2019. It was noticed that, overall, one of the studied classrooms achieved an acceptable range of Daylight Factor (DF). However, the other two classrooms were below the recommendations. The results found that the illuminance levels were not within the standard due to several factors contributing to the classroom design characteristics. Based on the observation analysis, the main factors contributing to design failures are poor classrooms orientation, double-loaded building with single-sided windows, small glazing area, low window placement, inappropriate glazing properties, and low light reflectance value. The classroom characteristics provide an advantage to achieve an optimum value of daylighting. This research contributes to the best practices of daylighting design for classrooms by providing recommendations to solve daylighting design failures in the existing classrooms. Finally, it is hoped this research will contribute to the discovery of problems impacting poor daylight efficiency in educational buildings, which can be used to foster a greater understanding of the benefits of daylighting for occupants.

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