



اَوْبُوْرُ سَيْتِي تَيْكُوْلُوْ كِي مَارَا  
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**UNIVERSITI TEKNOLOGI MARA**

**ACHIEVING OPTIMUM NATURAL  
DAYLIGHTING STRATEGIES IN A  
DESIGN STUDIO OF UiTM PERAK**

**MUHAMMAD ANAS BIN  
OTHMAN**

**MSc**

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## ABSTRACT

Malaysian universities are facing various environmental issues in the design studios due to the diverse activities and longer period of occupancy in this educational space. Students tend to stay in the design studios in a longer period which resulting towards inefficient use of energy, especially from the lighting aspect. Issue like gloomy or shaded areas due to inefficient natural lighting penetration has influenced the studio's users to use excessive artificial lighting even during the day. Whilst, issue like glare and over-lighting from the sunlight has influence the studio's users to use curtain or blinds which eventually leading to the use of artificial lighting. This may increase the electricity bill due to uncontrolled consumption of artificial lighting and produce more energy waste which can minimise the possibility of achieving greener spaces in a university. Therefore, this research aims to identify the optimum natural daylighting strategies that can be integrated in these design studios in order to improve the passive lighting penetration towards achieving greener spaces in a university. By identifying significant daylighting strategies, the utilisation of artificial lighting in the design studios can be reduced. UiTM Perak branch, a university that predominantly has design-based programs, has been chosen as the case study to test on this matter. This study involves the experimental research design which covers on the quantitative approaches to achieve the aim and objectives of this research. Through desktop study, and VELUX-simulation approach (supported by existing illuminance data), fundamental data on (i) green design data (based on lighting guideline), (ii) natural daylighting strategies matrix and (iii) sun path data have been correlated with (i) Validity using Illuminance Polar Curve Diagram, (ii) the relationship of illuminance reading and (iii) DF depth ratio graph. From the findings, it is found that light shelf (LS) strategy is the optimum daylight strategy that has significant potential to be applied in a studio and window with the area size of 6.54 m<sup>2</sup> is the best size to be integrated with LS. All daylighting strategies are formed and compiled in the suggested Daylighting Design Template (DDT) for future use of many parties, including building designers, educational institutions, maintenance management team and students. The ultimate benefit of this research is to help universities in Malaysia, to establish greener educational spaces in universities through effective natural daylighting penetration.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Chapter Overview

This chapter aims to elaborate the foundation issue of natural daylighting in educational spaces in public universities in Malaysia. The focus of this research is based on architectural studios in public universities in Malaysia, which predominantly utilise artificial lighting in the studios. The research has been discussed in several sections of this chapter including in the problem statement, which established the research aim, objectives, questions, scope and limitation.

### 1.2 Introduction

In establishing green building design, the key concepts needed are to create an energy efficient and environmentally friendly building, that is predominantly significant with today's sustainable concept of development (Zen *et al.*, 2016). Green building can be defined as an impetus in green construction scope, product and material innovation towards 'net zero buildings' or 'zero energy buildings' (Sharma, 2019). The green building design has been applied widely to numerous buildings, including residential, commercial and educational buildings. The contributing factors for this progression are (i) the rapid enforcement of global green rating index (Green Building Index Sdn. Bhd, 2017), (ii) the public needs towards environmental- friendly community (Setyowati, Rochma, and Nurul, 2013a) and (iii) the global awareness towards sustainable development (Ragheb, El-shimy, and Ragheb, 2016). This factor can be associated with green spaces and green architecture. Green spaces can be define as spatial layout improvement, green material usage, and enhance the indoor environment towards improving space utilization (Ming, 2017). Whilst, green architecture can be define as a relationship between building and natural in terms of minimize the number of resources in the building's construction field (Masood, Al-Hady, and Ali, 2017; Ragheb *et al.*, 2016).