

# Analysis of Natural and Artificial Lighting Performances for a Multi-functional Laboratory Using Smart Spectrometer and DIALux Evo Simulation

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## Abstract

Both natural and artificial illumination play a significant part in daily human activity. Natural lighting conditions influence energy consumption in buildings, as insufficient natural light can lead to increased electricity usage for artificial lighting. The multi-functional laboratory at the Department of Engineering Sciences, Faculty of Sciences and Techniques of Errachidia, needs adequate illumination levels that comply with the European lighting standard (EN 12464-1). This research study examines a novel approach for efficient lighting design that is specifically customized for laboratory settings. The study investigates the impact of illumination on various aspects of laboratory work, including productivity, safety, and laboratory staff's general welfare. The goal is to improve visual comfort, task performance, and energy efficiency. The process employs a blend of literature analysis, case studies, experiments, and simulations to assess the efficacy of the suggested lighting design approach. Firstly, we will start with a diagnostic examination of the current natural and artificial lighting system using a smart spectrometer to confirm, on the one hand, the level of illumination during daylight hours. Furthermore, to ascertain the lighting conditions by considering the current fluorescent tubes. On the other side, DIALux evo has been used to design smart lighting systems. A comparative research study was carried out, taking into consideration illuminance levels, homogeneity, glare, and energy usage. Finally, proposals were presented for employing artificial intelligence to boost the quality and efficiency of the proposed lighting design approach. The results provide valuable insights for architects, lighting designers, and laboratory managers looking to optimize lighting systems.

## Keywords

DIALux Evo Software, Visual Comfort, Smart Spectrometer