

Envisioning How to Improve Natural Light Flow and Energy Saving in Learning Spaces: A Case Study of an Engineering Drawing Room in a Semi-Desert Area

Sherif Helmy Ahmed

Lecturer, High Institute of Engineering, Dept. of Arch. Eng., 15May, Egypt.
dr.sherif15may@gmail.com

Abstract:

The study aims to highlight the importance of focusing on natural lighting in educational spaces, by focusing on increasing visual density and reducing energy consumption, thus contributing to the achievement of development goals. The study focused on the Engineering Drawing Room at the Higher Institute of Engineering in 15th of May City, addressing the problem of uneven natural light distribution in a self-drawing room. A digital panel simulation approach was used using VELUX Daylight Visualizer to study current lighting recommendations and test three scenarios: the current design, increasing window density by 30%, and integrating the Himawari Daylighting System with the removal of overhangs. Light distribution was evaluated at ten measurement points under different optional settings. Significant variations in lighting ranges were observed within the indicators, with close indicators and insufficient lighting in areas. Vascular dilation enhances brightness closer to different tissues. In contrast, the Himaure system demonstrated a relative improvement in providing contrasting illumination across languages, with a mean of 502.1 kd/m² and a minimum of 150 kd/m², while reducing heat loss. The study confirms the limitations of traditional daylighting trends and calls for the development of advanced performance-based solutions that combine architectural and architectural requirements. These findings provide an effective framework for enhancing the environmental performance of educational buildings, particularly in refurbished buildings, and a guide to constructing optimal, visually pleasing, and energy-efficient building environments.

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Natural multi-sports, sports, energy reduction, multi-sports, educational game solutions.

References:

- 1- (n.d.), H. (2025, March 15). Natural Light System. Retrieved from <https://www.himawari-net.co.jp/>
- 2- A. Mohammed. (2022). Study of Shading Device Parameters of the Mixed-Mode Ventilation on Energy Performance of an Office Building: Simulation Analysis for Evaluating Energy Performance in Egypt. *Advances in Architecture, Engineering and Technology*. Springer, Cham. doi:10.1007/978-3-030-86913-7_19
- 3- ASHRAE. (2019). ASHRAE Standard 62.1: Ventilation for Acceptable Indoor Air Quality. ASHRAE.
- 4- D. H. W., & Tsang, E. K. W. Li. (2008). An analysis of daylighting performance for classroom design in Hong Kong. *Building and Environment*, 43(5), 744–752.
- 5- G.D. Ander. (2003). *Daylighting Performance and Design*. Hoboken: NJ: John Wiley & Sons.
- 6- Google Earth. (2023). Google Earth. Retrieved from Google Earth.: <https://earth.google.com/web/>
- 7- L., & Torcellini, P. Edwards. (2002). A Literature Review of the Effects of Natural Light on Building Occupants. doi:10.2172/15000841.
- 8- M. Boubekri. (2008). *Daylighting, Architecture and Health: Building Design Strategies*. oxford: Elsevier.
- 9- M.-C. Dubois. (2001). Impact of solar shading devices on daylight quality: A pilot study. *Energy and Buildings*, 33(2), 105–118.
- 10- Mori Boulding Group. (2025). How Himawari brings sunlight into your room. Retrieved from La Foret engineering: <https://himawarisolar.com/himawari-solar-natural-lighting-system/how-it-works/>
- 11- N., & Steemers, K. Baker. (2002). *Daylight Design of Buildings: A Handbook for Architects and Engineers*. London: Earthscan.
- 12- NSP Egypt. (2025). NSP Egypt. Retrieved from NSP Egypt.: <https://nspegypt.com/>
- 13- P. R. Boyce. (2014). *Human Factors in Lighting* (3rd Edition). Boca Raton, Florida: CRC Press.
- 14- Parans Solar Lighting. (2025). *Daylight Transport Systems*. Retrieved from Parans Solar Lighting.:

- 15- R. Hopkins. (2012). *Lighting for Interior Design*. London: Laurence King Publishing.
- 16- Reinhart, C. (2014). *Daylighting Handbook I*. Boston: BTES.
- 17- Tregenza, P. &. (2011). *Daylighting: Architecture and Lighting Design*. London: Routledge.
- 18- VELUX Group. (2024). *VELUX Daylight Visualizer (Version 4.0)* [Computer software for Windows]. VELUX Group. Retrieved from <https://www.velux.com/what-we-do/daylight-visualizer>
- 19- Researcher. (2024). *VELUX Daylight Visualizer (Version 4.0)* [Computer software for Windows] Analytics using VELUX Group.
- 20- Researcher. (2025). Unpublished field data collected during research on the Higher Institute of Engineering in 15th of May City. Cairo, Egypt: Researcher.
- 21- Al-Gohary, Sahar Ahmed. (2022). *The Role of Architectural Design in Promoting Environmental Sustainability by Improving Natural Lighting in School Buildings*. Zagazig, PhD Thesis, Egypt: Zagazig University.
- 22- Al-Mulla, Hesham Gamal. (2016). *Introduction to Energy-Efficient Building Design*. Cairo: Egyptian General Book Organization.
- 23- Hassan, Ahmed Abdel Rahim (2011). *Fundamentals of Environmentally Friendly Building Design*. Cairo: Anglo-Egyptian Library.
- 24- Radi, Mona Ahmed (2020). *Using Natural Lighting Simulation Systems to Evaluate the Efficiency of Existing Educational Buildings*. Cairo, PhD Thesis, Egypt: Ain Shams University.
- 25- Suad Mustafa Al-Sayyad (2019). *Analysis of the Lighting Performance of Art Rooms Using Natural Lighting Simulation*. International Journal of Engineering Sciences and Technology.
- 26- Abdel Ghaffar, Salah Abdel Azim (2009). *Environmental Considerations in Building Design*. Cairo: Zahraa Al-Sharq Library.
- 27- Abdullah, Doaa Mahmoud (2019). *The Impact of Natural Lighting on the Performance Efficiency of Higher Education Buildings in Egypt*. Cairo, Master's Thesis, Egypt: Cairo University.
- 28- Abdel Fattah, Lamia Mustafa (2018). *Environmental Analysis of the Impact of Natural Lighting on the Design of Open Educational Spaces*. Alexandria, Master's Thesis, Egypt: Alexandria University.
- 29- Fahmy, Naglaa Saeed (2021). *The Effect of Architectural Orientation on the Efficiency of Natural Light Distribution in Classrooms*. Cairo, Master's Thesis, Egypt: Minya University.
- 30- Ministry of Housing and Urban Communities. (2020). *Statistical Data for First-Generation Cities*. 15th of May City: General Authority for Urban Planning.
- 31- Youssef, Hala Mahmoud. (2017). *Architectural Factors Affecting the Efficiency of Natural Light in Educational Buildings in Greater Cairo*. Cairo, Master's Thesis, Egypt: Helwan University.

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