

The Influence of Daylight Penetration on Wayfinding Performance in Circulation Spaces of Faculty of Architecture Building.

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Abstract- Wayfinding performance in educational institutions is greatly influenced by environmental elements and the quality of architectural spaces. Faculty of Architecture buildings frequently have intricate circulation networks that require users to comprehend spatial linkages and traverse effectively. These networks include studios, lecture halls, offices, workshops, galleries, and communal spaces. Confusion, a lack of spatial awareness, and a poor user experience can all result from poorly designed circulation spaces. By improving visibility, establishing boundaries, and facilitating movement within architectural spaces, daylight penetration is a significant environmental aspect that affects spatial perception. The impact of daylight penetration on wayfinding performance in circulation areas of Faculty of Architecture buildings is investigated in this study. It looks into how user orientation, movement patterns, and navigational skills are impacted by the availability, distribution, and depth of natural light. The study uses architectural observation with a few chosen case studies. Spatial analysis and user-based assessment to evaluate circulation elements. The findings highlight how daylight-responsive strategies can improve spatial clarity, circulation experience, and wayfinding in buildings.

Keywords: *Daylight penetration, Wayfinding Performance, Circulation Spaces, Spatial Orientation, User Navigation.*

I. INTRODUCTION

Wayfinding is a fundamental aspect of human interaction with the built environment, influencing how users perceive, interpret, and navigate architectural spaces. In complex buildings, successful wayfinding depends on users' ability to understand spatial organisation, identify destinations, and develop mental representations of their surroundings.

Kevin Lynch explains in his book *Image of the City* that people interpret environments through identifiable elements such as paths, nodes, landmarks, edges, and districts, which contribute to the formation of cognitive maps and improve spatial orientation.

According to (Hafiz & Dalia, 2015) One of the main components of space identification and a crucial aspect of spatial quality is daylighting. According to the author, people's perceptions and distinctions of places within a building are greatly influenced by natural light.

This concept is especially pertinent to wayfinding since effective navigation relies on users' capacity to identify and distinguish between locations as they pass through them.

Daylight can assist in creating visual hierarchy and make circulation routes more readable in a Faculty of Architecture building, where circulation networks frequently include hallways, atriums, staircases, bridges, and studios. Educational buildings, particularly the Faculty of Architecture buildings, often present significant wayfinding challenges due to their complex functional arrangements.

(Laura, Carlson, Hoelscher, Shipley, & Dalton, 2011). Studios, lecture halls, workshops, offices, galleries, libraries, critique halls, and collaboration spaces are frequently housed in these buildings, creating a variety of movement sequences and circulation patterns. Because of the intricacy of these settings, users must constantly assess spatial relationships and make choices while navigating.

The physical features of buildings, such as their spatial arrangement and complexity, have an impact on users' capacity to make precise cognitive maps and carry out efficient wayfinding, according to research on architectural legibility.

Circulation spaces play a critical role in supporting wayfinding because they serve as the primary routes through which users move between different functional areas. Corridors, staircases, entrances, and transitional spaces provide visual and spatial information that helps users understand building organisation (Asya, Natapov, Kuliga, Conroy, & Hölscher, 2019).

However, when circulation spaces lack clear spatial relationships, visibility, or recognisable environmental cues, users may experience confusion, inefficient movement, and increased dependence on signage or external assistance.

Studies on wayfinding in complex buildings indicate that increased spatial complexity can negatively affect navigation time, route selection, and the occurrence of wrong turns. (Saman, Mahnaz, & Debajyoti, 2020).

Beyond spatial configuration, environmental conditions also influence how users perceive and interact with architectural spaces. Daylight is an important environmental factor that contributes to visual perception, spatial experience, and the understanding of architectural forms. Daylighting affects how occupants perceive depth, boundaries, hierarchy, and visual relationships within spaces.

(Hafiz D., 2015) emphasizes that daylighting contributes to the quality of architectural environments by influencing visual comfort, spatial perception, and the overall experience of space.

However, daylighting must be carefully considered because poor distribution can create glare, uneven lighting conditions, and visual discomfort. In particular, daylight penetration describes how much natural light enters and reaches a building's interior spaces.

In circulation areas, efficient daylight penetration can enhance visibility, highlight movement routes, delineate space transitions, and generate visual cues that facilitate user orientation. Research on daylight perception indicates that variations in luminance and daylight distribution influence the perception of spatial depth and visual understanding of architectural environments. (TAI, 2012).

1.1 PROBLEM STATEMENT

Daylight is a fundamental component of building design because it influences visual comfort, spatial perception, occupants' well-being, and the overall quality of indoor environment.

Yet, inadequate daylight distribution may result in glare and visual discomfort, which can adversely affect users' visual performance and interaction with architectural spaces (Hafiz D., 2015).

The ability of users to recognise environmental cues, comprehend spatial structure, and move through circulation areas effectively is essential for wayfinding within faculty buildings.

The configuration of circulation networks has been shown to influence anticipated wayfinding difficulty, making circulation design a key determinant of navigation performance (Asya, Natapov, Kuliga, Conroy, & Hölscher, 2019).

The interconnected studios, lecture halls, workshops, galleries, and other learning areas found in most faculty of architecture buildings create intricate circulation systems that require efficient spatial orientation.

Although extensive research has examined daylighting in educational buildings and its influence on environmental quality and occupant performance, existing studies have largely focused on classrooms and learning spaces rather than on circulation areas where navigation and orientation primarily occur (Costanzo, Vincenzo, Evola, & Marletta, 2017) (Hafiz D., 2015).

As a result, there is no empirical data regarding how daylight penetration affects wayfinding efficiency in Faculty of Architecture buildings' circulation areas.

In order to improve spatial legibility, user orientation, and navigation efficiency in architectural education facilities, it is imperative to close this gap and develop design techniques that incorporate daylighting with circulation planning.

1.2 AIM OF THE STUDY

This study investigates the influence of daylight penetration on wayfinding performance in circulation spaces of Faculty of Architecture buildings to understand how natural lighting conditions affect spatial legibility, user orientation, and navigation efficiency within architectural learning environments.

1.3 OBJECTIVES

There are 4 primary objectives to guide the study. They are;

1. To identify the daylight penetration strategies applied in circulation spaces of selected case studies of the Faculty of Architecture.
2. To examine the influence of daylight penetration on spatial legibility and wayfinding performance within circulation spaces of selected case studies.
3. To analyze the relationship between daylighting design features and user orientation within architectural learning environments.
4. To compare different daylight approaches used in international Faculties of Architecture buildings and their effectiveness in supporting wayfinding.

1.4 RESEARCH QUESTIONS

1. What daylight penetration strategies are incorporated into circulation spaces of selected Faculties of Architecture buildings?
2. How does daylight penetration influence spatial legibility and wayfinding performance within circulation spaces of Faculty of Architecture buildings?
3. What relationship exists between daylighting design features and users' ability to orient and navigate within architectural learning environments?
4. How do different daylighting approaches affect the effectiveness of circulation spaces in supporting wayfinding?

II. LITERATURE REVIEW

2.1 Wayfinding Performance in Architectural Spaces

The cognitive and behavioural processes through which people perceive, understand, and navigate the built environment utilising spatial information and environmental cues are referred to as wayfinding in architectural settings.

Contemporary studies emphasise that wayfinding is not only a navigation task but a cognitive interaction between users and spatial configurations, where memory, perception, and decision-making play key roles. (Asya, Natapov, Kuliga, Conroy, & Hölscher, 2019).

Circulation systems have a big impact on how simple it is for people to move around and find their way around in intricate academic buildings like Faculties of Architecture. Poorly structured layouts often increase cognitive load, resulting in disorientation and inefficient movement patterns, especially for first-time users. (Devlin, 2014).

2.2 Daylight Penetration and Spatial Perception

One significant architectural feature that influences how people view and interact with interior spaces is daylight penetration. In addition to increasing contrast and visibility, natural light aids users in recognising key environmental elements and spatial boundaries.

By highlighting routes, exits, intersections, and transitional zones, daylight can aid in orienting in circulation areas. Lighting conditions influence human visual performance and perception by affecting the ability to recognise objects, spaces, and spatial relationships (Boyce, 2014).

Therefore, daylight is not only an environmental strategy for reducing energy consumption but also a perceptual tool that contributes to the understanding of architectural spaces.

According (Ohochuku, Pepple, & F. F. O, 2025) Daylight significantly influences occupant mood, spatial behaviour, and indoor comfort; however, the study examines how daylight perception and user-controlled illuminance adjustments shape occupant

preferences, spatial use, and behavioural responses in various spaces.

2.3 Relationship Between Daylighting and Wayfinding

Wayfinding depends on the availability of clear environmental information, such as visibility, spatial hierarchy, and visual cues, that help users understand and navigate buildings. Daylight penetration improves these cues by enhancing visibility, contrast, and important destinations (Boyce, 2014).

As a result, daylight can enhance wayfinding and spatial legibility in circulation areas. Daylighting facilitates navigation in complex environments, such as academic buildings, by enhancing visual consistency and creating identifiable spatial markers through light gradients, apertures, and façade transparency.

Studies in environmental cognition suggest that users rely heavily on visual cues such as brightness variation and natural light entry points to construct mental maps of unfamiliar environments (Saif & Chris, 2020).

2.4 Circulation Spaces in Faculty of Architecture Buildings

Because they connect various learning areas and direct user movement, circulation spaces are crucial components of Faculty of Architecture buildings. The effectiveness of these spaces depends on clear organisation, visual accessibility, and ease of orientation. (O'Neill, 1991).

Poorly defined circulation paths can reduce spatial understanding and create navigation difficulties, while well-designed spaces with strong visual connections can improve user movement and wayfinding efficiency. (Dogu & Erkip, 2000).

III. METHODOLOGY

This study adopts a qualitative comparative case study approach to examine the influence of daylight penetration on wayfinding performance in circulation spaces of selected Faculty of Architecture buildings.

It relies on secondary data sources such as architectural drawings, published case studies, photographs, and virtual materials of selected international and local buildings.

The analysis is carried out through document review, visual assessment, and spatial mapping to evaluate daylight penetration and circulation patterns. A comparative method is then used to assess how different daylight strategies influence spatial legibility and wayfinding performance, supported by established theories of Kevin Lynch, Arthur, and Passini.

3.1 CASE STUDY SELECTION CRITERIA

The following standards were used to select these case studies:

i. Building Type Relevance:

The selected buildings must be Faculty of Architecture or architecture-related academic buildings to ensure direct relevance to the study context.

ii. Presence of Circulation Complexity:

Buildings must have clearly defined circulation systems such as corridors, staircases, atriums, and transitional spaces suitable for wayfinding analysis.

iii. Daylighting Strategies:

The case studies must demonstrate visible daylight-penetration strategies, such as courtyards, skylights, atriums, or large glazed openings.

iv. Availability of Data:

Adequate architectural documentation (plans, sections, photographs, and published studies) must be available for analysis.

v. International and local Representation:

Selected case studies should be from both local and international contexts to allow comparative analysis of design approaches.

vi. Design Recognition/Quality:

Preference is given to well-documented or architecturally significant buildings that are widely studied or published in academic and professional source

3.2 CASE STUDY 1: Faculty of Architecture and Environmental Design, Rwanda (ArchDaily, 2018)

Location: Kigali, Rwanda

Architect: Patrick Schweitzer & Associés

Capacity: 900 students

Year and Area: 2017 and 5600m²

The architecture Practice Patrick Schweitzer & Associés responded to the international call launched by the Government of Rwanda in March 2012 for the construction of the new Faculty of Architecture in Kigali. This school covers an area of 5,600 square meters and can accommodate 600 students. It is located on the University of Rwanda's College of Science and Technology campus in Nyarugenge District. The works started in early 2017 and were completed in 2018 (urbanNext, 2020).

The faculty of Architecture and Environmental Design, Rwanda, demonstrates that Daylight penetration can function beyond illumination by supporting spatial understanding and user movement. The building provides a relevant example of how daylight strategies can enhance circulation quality and wayfinding performance in architectural education facilities.



Figure 1: Sections showing how daylight penetrates the building through skylights and glass curtain walls.

Source: ArcDaily.com

i. Daylight Penetration Analysis

The building incorporates environmental strategies through its relationship with nature, including internal gardens, open circulation areas, and spatial openings that allow natural light to enter and support visual connections between spaces. The use of open circulation paths and courtyards enhances daylight access, reducing dependence on artificial lighting while improving the perception of interior spaces. (Alana, 2018).

ii. Wayfinding and Circulation Analysis

The circulation systems are a major design feature of the building, expressed through external walkways, connecting bridges, and open movement paths between different building volumes. These elements create visual continuity and allow users to understand connections between spaces more easily. The presence of open circulation zones and visible transitions between areas supports wayfinding by providing environmental cues and improving spatial legibility. (urbanNext, 2020).

iii. Relationship Between Daylight and Wayfinding Performance

From a wayfinding perspective, integrating daylight into circulation spaces strengthens orientation by improving visibility, highlighting movement routes, and creating recognisable spatial points. The combination of natural lighting, open circulation, and visual connections demonstrates how daylight penetration can contribute to improved navigation within architectural learning environments. (urbanNext, 2020).

iv. Case Study Evaluation Summary



Figure 2: Site plan and Ground Floor Plan showing the circulation routes and spaces.

Source: ArcDaily.com



Figure 3: 3D model and First Floor Plan showing the circulation routes, spaces, and Skylights for Daylight Penetration.

Source: ArcDaily.com

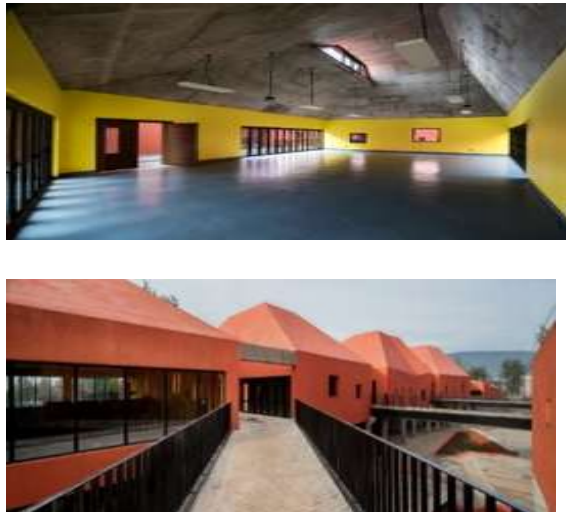


Figure 4: Photos showing the Interior Spaces with the Skylight and the Bridge for Circulation.

Source: ArcDaily.com

3.2 CASE STUDY 2: NUS School of Design and Environment (ArcDaily, 2019)

Location: 8 Architecture DR, Singapore

Architect: Serie architects, Multiply architects, Surbana Jurong

Year and Area: 2019 and 8500m²

The NUS School of Design and Environment (SDC) in Singapore is selected as a case study due to its relevance as an architecture education building that

integrates environmental design strategies with learning spaces.

Designed by Serie Architects with Multiply Architects and Surbana Jurong, the building focuses on creating an open, flexible, and climate-responsive learning environment through daylighting, natural ventilation, and connected circulation spaces. (Arch2O, 2019).

i. Daylight Penetration Analysis

The building incorporates daylight strategies through open facades, large glazed areas, and environmental design features that allow natural light to penetrate deep into the interior spaces. The design uses shading elements and roof overhangs to control solar gain while maintaining daylight access, improving visual comfort, and reducing dependence on artificial lighting. (Arch2O, 2019).

ii. Wayfinding and Circulation Analysis

The circulation systems of SDE are organised around open and interconnected spaces that encourage visibility and movement between studios, social areas, and learning zones. A central circulation promenade and visible communal spaces create strong visual connections, allowing users to understand relationships between different parts of the building. These features support wayfinding by providing clear paths, landmarks, and spatial cues. (College of Design and Engineering, 2019).

iii. Relationship Between Daylight and Wayfinding Performance

By increasing visibility and establishing identifiable zones within the building, the incorporation of daylight into circulation spaces improves spatial intelligibility. Users may navigate more simply by comprehending movement patterns and destinations because of the circulation system's openness, natural light, and visual linkages. This demonstrates how daylight penetration can function as a wayfinding element beyond its environmental benefits. (College of Design and Engineering, 2019).

iv. Case Study Evaluation Summary

Daylighting and wayfinding performance are strongly correlated, according to the NUS School of Design and Environment. Users can better

orient themselves in a building environment thanks to the usage of daylight, open circulation, and visual continuity. The case provides evidence that daylight penetration can support spatial clarity and improve circulation in Faculty of Architecture buildings. (Arch2O, 2019).



Figure 5: A 3D model of the Staircase of the building.
Source: College of Design and Engineering, National University of Singapore

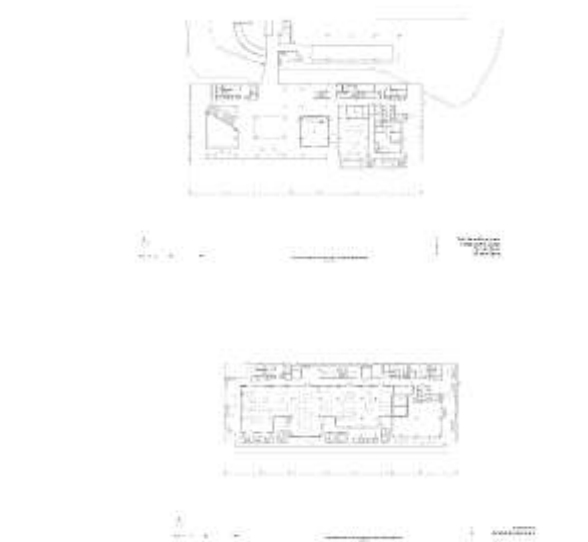


Figure 6: Floor Plans of the building showing the circulation spaces and the spaces.

Source: College of Design and Engineering, National University of Singapore

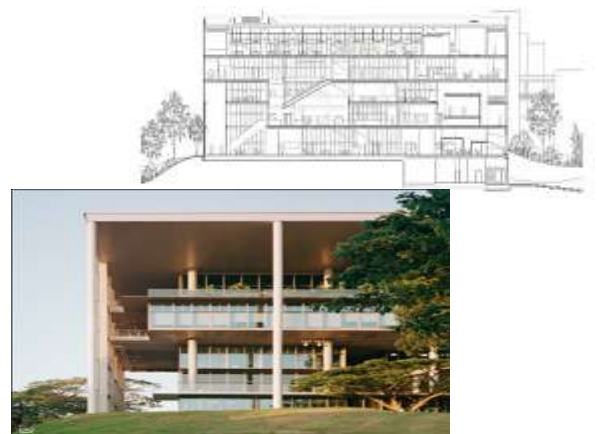


Figure 7: A Section View of the building and Interior Photography showing the Circulation Spaces and an Exterior Photography showing the Overhang and Glass facade of the building

Source: College of Design and Engineering, National University of Singapore

3.3 CASE STUDY 3: Faculty of Environmental Sciences, University of Lagos

Location: Akoka, Yaba, Lagos State, Nigeria

Year: Established in the 1970s; developed incrementally over time

The Faculty of Environmental Science at the University of Lagos is selected as a case study because it represents an academic environment in which architecture, environmental design, and user movement are integrated.

The faculty accommodates departments related to the built environment, including Architecture, Building, Estate Management, and Urban and Regional Planning, making it relevant for analysing circulation and wayfinding within an educational building context (University of Lagos, n.d.).

i. Daylight Penetration Analysis

The building demonstrates a traditional academic block arrangement with large window openings along the external walls that allow natural light to penetrate internal spaces. The use of perimeter openings supports daylight access and improves visual conditions within classrooms and circulation areas. However, the depth of some spaces and the linear arrangement of blocks may affect how far daylight penetrates interior zones. Natural lighting is therefore stronger near external walls, but may reduce towards deeper circulation areas (LCU, 2022).

ii. Wayfinding and Circulation Analysis

Classrooms, offices, lecture halls, and laboratory spaces are all connected blocks that make up the building's plan. Linear circulation pathways that connect various functional regions are the main means of organising movement. This arrangement provides a clear relationship between major spaces; however, users may rely on architectural cues such as entrances, building openings, and visual connections to understand movement direction. The presence of open external areas and

separated blocks contributes to orientation by allowing users to visually identify different destinations (University of Lagos, n.d.).

iii. Relationship Between Daylight and Wayfinding Performance

From a wayfinding perspective, daylight penetration contributes to spatial clarity by improving visibility along circulation paths and helping users recognise important transition points such as entrances and shared spaces. In the UNILAG Faculty of Environmental Science, natural light supports orientation mainly through façade openings and outdoor visual connections rather than internal daylight features such as atriums or skylights. This suggests that while daylight improves visibility, stronger daylight-focused design strategies could further enhance circulation legibility.

iv. Case Study Evaluation Summary

The UNILAG Faculty of Environmental Sciences exhibits daylight-supported areas and efficient circulation. However, it offers less interior daylight direction than schools of modern design that use courtyards and atriums. The case study emphasises how crucial it is to incorporate daylighting techniques into circulation planning in order to enhance wayfinding efficiency.

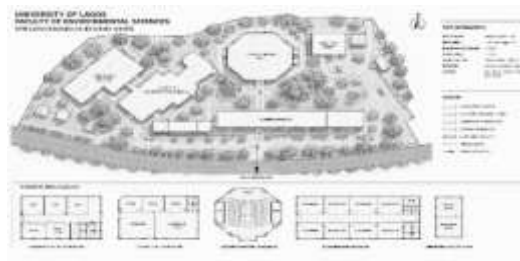




Figure 8: A Site Layout and Photography from the Courtyard.

Source: Google Earth and the University of Lagos, Faculty of Environmental Science.



Figure 9: A photograph of the Entrance and photography of the Department of Architecture Building.

Source: Google Earth



Case Study	Location	Year	Architectural Type	Daylight Penetration Strategy	Circulation Strategy	Wayfinding Performance Outcome	Key Insight
Faculty of Architecture and Environmental Design, Kigali	Kigali, Rwanda	2017–2018	Faculty of Architecture	Courtyards, open walkways, inter-building gaps, internal gardens	External bridges, visible circulation paths, open-air connections	Strong spatial legibility due to visual continuity between blocks	Daylight is integrated with circulation, making movement paths visually obvious and intuitive
NUS School of Design and Environment	Singapore	2019	School of Design & Environment	Skylights, glazed façades, shaded openings, controlled daylight	Central promenade, interconnected studios, visible vertical circulation (stairs/bridges)	Very strong wayfinding due to clear spatial hierarchy and landmark zones	Daylight and circulation are fully integrated to create “readable” learning environments
Faculty of Environmental Sciences,	Lagos, Nigeria	1970s (incremental development)	Faculty building complex	Perimeter windows, basic	Linear corridors, block-to-	Moderate wayfinding; reliance	Daylight supports only

University of Lagos		t)		façade openings, limited deep penetration	block connections, outdoor orientation points	on external cues due to weak internal daylight depth	perimeter navigation; weak interior guidance reduces spatial clarity
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3.4 Comparative Analysis of Selected Case Studies
With an emphasis on daylight methods, circulation design, spatial intelligibility, and user orientation, the comparative analysis looks at the relationship between daylight penetration and wayfinding performance in a few faculty of Architecture buildings in Rwanda, Nigeria, and Singapore.

IV. KEY FINDINGS AND DISCUSSION

The comparative analysis of the selected case studies reveals the following key findings;

- i. Daylight penetration enhances spatial legibility and wayfinding performance.
The case studies demonstrate that structures that incorporate daylight into circulation areas, such as the Rwanda Faculty of Architecture and NUS SDE, offer more powerful visual cues for user orientation and navigation.
- ii. Circulation spaces with visual continuity improve user movement.
By assisting users in recognising routes and comprehending spatial linkages, open circulation, courtyards, and connected areas enhance navigation.
- iii. Daylight functions as more than an illumination strategy.
In addition to increasing visibility, daylight serves as a cue that draws attention to important locations, establishes landmarks, and enhances spatial comprehension.
- iv. Limited daylight integration reduces wayfinding effectiveness.
The case study from the UNILAG Faculty of Environmental Sciences shows that circulation areas may support user orientation less when daylight is primarily used for basic illumination rather than spatial guiding.
- v. Successful daylight-driven wayfinding requires integration with spatial planning.

The results show that daylight works best when paired with a well-organised spatial plan, a clear circulation hierarchy, and obvious connections.

V. RECOMMENDATION

The following suggestions are put forth to enhance wayfinding performance through daylight integration in Faculty of Architecture buildings in light of the study's findings:

- i. Use daylight as a wayfinding tool by highlighting key routes, entrances, stairs, and transition zones, not just for illumination.
- ii. Strengthen visual connections through open corridors, courtyards, atriums, and transparent and translucent elements to improve spatial legibility.
- iii. Improve daylight distribution in circulation areas using skylights, clerestories, light wells, and internal courtyards to avoid poorly lit zones.
- iv. Integrate daylighting with clear spatial organisation, visible landmarks, and a strong hierarchy of spaces to support navigation.
- v. Apply climate-responsive design in tropical regions by using shading devices, proper orientation, and controlled openings to balance comfort and daylight.
- vi. Include a user-centred evaluation to ensure daylighting strategies actually improve wayfinding and user experience in circulation spaces.

CONCLUSION

By increasing visibility, spatial clarity, and user orientation, daylight penetration dramatically improves wayfinding performance in circulation areas of Faculty of Architecture buildings, according to the study. Daylight can actively direct movement, emphasise important nodes, and improve spatial comprehension rather than just serving as lighting.

Nonetheless, a lot of current structures continue to use daylight without a defined design intention, which results in poor spatial intelligibility and difficulties with navigation. The creation of daylight-guided circulation systems, which strategically employ features like atriums, skylights, light wells, and transparent corridors to direct movement and emphasise decision points, is an inventive strategy.

By using adaptive lighting control and fusing natural light techniques with digital or visual wayfinding signals in intricate academic settings, future designs can further enhance performance. In general, the study highlights a transition from passive lighting design to deliberate daylight-driven spatial organization, where daylight becomes an essential architectural tool for improving user experience and circulation efficiency.

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