



**Evaluation of Sustainable Daylighting Strategies for Sensory-Inclusive Learning Environments for Visually Impaired Pupils in Lagos Secondary Schools**

**Toluwalope Florence Olagunju<sup>1</sup> & Adekunle Solomon Babamboni<sup>2</sup>**

Department Of Architecture, College of Environmental Science and Management, Caleb University, Imota, Ikorodu, Lagos, Nigeria.

Corresponding Author: [toluwalope.olagunjug24@calebuniversity.edu.ng](mailto:toluwalope.olagunjug24@calebuniversity.edu.ng)

**ABSTRACT**

*Natural daylight plays an important role in the design of educational buildings because it affects energy performance, indoor environmental quality, and visual comfort. For pupils with visual impairments, appropriate lighting conditions are particularly important because they influence reading ability, visual endurance, and spatial orientation within learning environments. The research evaluates documented sustainable daylighting strategies and examines their implications for sensory-inclusive learning environments in Lagos secondary schools serving visually impaired pupils. A qualitative document-based analytical approach was adopted, drawing on peer-reviewed literature, published architectural case studies, and recognised lighting standards. Three case studies were selected because they provide both local and international examples of schools designed for visually impaired pupils: Pacelli School for the Blind in Lagos, Nigeria; Singapore School for the Visually Handicapped in Singapore; and Hazelwood School in Glasgow, United Kingdom. Documented daylighting strategies were analysed in relation to illuminance adequacy, luminance uniformity, and glare conditions, and interpreted in relation to visual comfort requirements and principles of sensory-inclusive design. Findings show that the international case studies integrate deliberate daylight control strategies such as external shading, diffused glazing, recessed openings, and daylight redirection systems. These strategies are associated with more uniform illumination, reduced glare, and visually stable classroom environments. By comparison, many school buildings in Lagos rely primarily on side windows with limited daylight control, a condition that can produce uneven illumination and glare within classrooms. The study demonstrates that sustainable daylighting strategies support both environmental performance and accessibility when they are carefully designed to regulate light entry and distribution. It proposes daylighting design guidelines that respond to the climatic and educational context of Lagos.*

**Keywords:** Sustainable daylighting, sensory-inclusive learning environments, visual comfort, visually impaired pupils

**INTRODUCTION**

Natural daylight is an important component of educational building design because it influences both energy consumption and the visual quality of learning environments. Classrooms with well-distributed daylight provide improved visual conditions while reducing reliance on artificial lighting. (Frontczak et al., 2020; Nguyen et al., 2020). As a result, daylighting is increasingly considered not only as a strategy for energy efficiency but also as a design element that contributes to the overall performance of educational spaces. Designing for daylight in tropical climates presents additional challenges because high solar intensity can create glare and uneven classroom lighting. As a result, factors such as façade orientation, glazing type, window proportions, and shading devices become critical in determining how daylight spreads within a learning space. (Al-Tamimi & Fadzil, 2021; Konis et al., 2021). Where these parameters are poorly resolved, classrooms commonly experience over-illumination near openings and inadequate daylight at room depth, resulting in visual discomfort and reduced learning effectiveness.

Lighting quality is particularly critical for pupils with visual impairments, as learners with low vision require higher illuminance levels and effective glare control to sustain visual tasks comfortably. (Papadopoulos et al., 2020; Stringham et al., 2021). Classroom lighting characterised by adequate illuminance, luminance uniformity, and minimal glare supports reading performance, visual endurance, and task persistence (Bose, 2025). In recent years, architects and educators have increasingly explored sensory-

inclusive design approaches for schools. This approach focuses on adjusting environmental conditions so that students with different sensory needs can comfortably participate in learning activities. (Poon et al., 2022; Gaines et al., 2023). Recent studies further demonstrate that diffused daylight and glare-free classroom environments reduce eye strain and improve mobility confidence for visually impaired pupils (Hasan & Sharmin, 2025). Studies on Nigerian school buildings have mainly examined daylighting from the perspective of classroom performance and energy efficiency. Many investigations report problems such as glare and uneven light distribution where shading devices and glazing control are absent (Adebamowo, 2024; Ede et al., 2024), while evidence indicates that external shading, light shelves, and orientation-sensitive façade design can significantly improve daylight distribution and visual comfort (Ohochuku et al., 2025). However, limited architectural research explicitly examines daylighting strategies in schools serving visually impaired pupils or evaluates these strategies through a sensory-inclusive lens.

Despite growing research on classroom daylighting and inclusive learning environments, limited architectural studies examine how sustainable daylighting strategies can support sensory-inclusive environments for visually impaired pupils within the Lagos context. This study therefore evaluates documented sustainable daylighting strategies used in inclusive secondary schools and examines their implications for sensory-inclusive learning environments for visually impaired pupils in Lagos.

The study addresses the following objectives:

1. Review literature on sustainable daylighting requirements and visual comfort needs of visually impaired pupils in learning environments.
2. Compare documented sustainable daylighting strategies in selected inclusive secondary schools in Lagos and comparable international contexts.
3. Develop context-responsive sustainable daylighting design guidelines for sensory-inclusive secondary schools in Lagos.

#### **Operational Definitions**

1. **Sustainable Daylighting Strategies** – Architectural design approaches that optimise the use of natural light to reduce dependence on artificial lighting while maintaining visual comfort, energy efficiency, and climatic responsiveness (Al-Tamimi and Fadzil, 2021; Haddad and Li, 2023).
2. **Sensory-Inclusive Learning Environment** – A learning environment intentionally designed to accommodate diverse sensory abilities by regulating environmental stimuli such as lighting, acoustics, and spatial organisation to support equitable participation (Poon, Wong, and Lam, 2022; Gaines, Bourne, Pearson, and Kleibrink, 2023).
3. **Visual Impairment** – A reduction in visual function that cannot be fully corrected and that interferes with everyday activities, including learning (Papadopoulos, Barouti, and Koustriava, 2020).
4. **Visual Comfort** – A condition in which lighting provides adequate illuminance, minimal glare, and appropriate luminance distribution to support sustained visual tasks without discomfort (Stringham, Garcia, and Smith, 2021; Bose, 2025).

## **LITERATURE REVIEW**

### **Sustainable Daylighting in Educational Architecture**

Daylighting is widely recognised as a critical component of sustainable educational building design because it influences energy consumption, indoor environmental quality, and occupant comfort. Empirical studies demonstrate that well-distributed daylight improves visual conditions in classrooms while reducing reliance on artificial lighting (Frontczak, Schiavon, Goins, Arens, Zhang, and Wargocki, 2020; Nguyen, Reiter, and Rigo, 2020; Li, Wong, Tsang, and Cheung, 2020; Acosta, Campano, Molina, and Domínguez-Amarillo, 2021). Contemporary architectural research therefore emphasizes balanced light distribution rather than simply increasing window area. Daylight performance in classrooms is influenced by façade orientation, window proportions, glazing specification, and the integration of shading and daylight-modulating devices (Konis, Gamas, and Kensek, 2021; Mardaljevic, Brembilla, and Drosou, 2021). In warm climates, uncontrolled daylight penetration can produce glare and excessive luminance contrast, while insufficient daylight leads to poor visibility and increased dependence on electric lighting. The incorporation of external shading devices, recessed openings, and controlled glazing has been shown to improve luminance uniformity and reduce glare probability in educational buildings (Al-Tamimi and Fadzil, 2021; Haddad and Li, 2023; Lim and Heng, 2020). Broader architectural research further emphasises that sustainable building

performance depends on integrated environmental design strategies that combine façade systems, material technologies, and passive design approaches to regulate indoor environmental conditions (Afolabi, Ibitoye, Grace, and Olaoye, 2025; Ibitoye, 2025). These studies reinforce the importance of coordinated architectural strategies in achieving environmentally responsive and comfortable learning environments.

### **Visual Comfort and Lighting Requirements for Visually Impaired Pupils**

Visual impairment involves reduced visual function that affects reading, contrast perception, and task performance within learning environments. Pupils with low vision generally require higher illuminance levels than normally sighted users, alongside effective glare control, to sustain visual tasks comfortably (Papadopoulos, Barouti, and Koustriava, 2020; Stringham, Garcia, and Smith, 2021; Legge, Bigelow, and Schuchard, 2021; Bowers and Meek, 2020). Lighting environments characterised by excessive luminance contrast or direct glare disrupt visual adaptation and contribute to eye strain and reduced task persistence. Synthesis of classroom-based studies indicates that effective learning environments for visually impaired pupils are defined by adequate illuminance, stable luminance distribution, and minimal glare rather than high daylight levels alone (Bose, 2025). Diffused daylight conditions have also been associated with reduced discomfort and improved mobility confidence in inclusive school settings (Hasan and Sharmin, 2025). These findings reinforce broader architectural research indicating that sustainable building strategies must integrate environmental design considerations, including envelope performance and material systems, in order to improve occupant comfort and building efficiency (Haddad and Li, 2023; Ibitoye, 2025).

### **Sensory-Inclusive Learning Environments and the Role of Lighting**

Sensory-inclusive design emphasises the planning of learning environments to accommodate diverse sensory abilities and reduce environmental barriers to participation. Rather than focusing solely on physical accessibility, this approach prioritises regulation of sensory stimuli to support comfort, orientation, and engagement (Opitz, 2022; Mostafa, 2020). Environmental predictability and stability are therefore central to inclusive learning. Lighting is consistently identified as one of the most influential sensory stimuli shaping classroom experience. Reviews of sensory-friendly school environments indicate that uncontrolled brightness, glare, and fluctuating lighting conditions are associated with discomfort and reduced concentration, while stable and well-modulated lighting supports sustained engagement (Poon, Wong, and Lam, 2022). Architectural studies further demonstrate that lighting conditions influence spatial legibility and perceptions of safety and comfort, particularly for learners who rely heavily on environmental cues for orientation (Gaines, Bourne, Pearson, and Kleibrink, 2023; Barrett, Davies, Zhang, and Barrett, 2020). Accordingly, daylighting strategies contribute to sensory inclusion when they deliver predictable, glare-free, and visually stable environments.

### **Sustainable Daylighting Strategies in Warm and Tropical Climates**

Climate-responsive design plays a critical role in determining the effectiveness of daylighting strategies. In warm and tropical regions, high solar intensity increases the risk of glare and thermal discomfort, making daylight modulation essential. External shading devices, recessed openings, and controlled glazing significantly improve daylight distribution and reduce glare probability in educational buildings (Al-Tamimi and Fadzil, 2021; Haddad and Li, 2023; Lim and Heng, 2020; Hiyama, Wen, and Tanaka, 2021). Additional research identifies light shelves, reflective ceiling surfaces, and optimised façade orientation as effective means of redirecting daylight deeper into classrooms and improving luminance uniformity (Konis, Gamas, and Kensek, 2021; Nguyen, Reiter, and Rigo, 2020; Mardaljevic, Brembilla, and Drosou, 2021). These strategies support a performance-driven approach to sustainable daylighting that balances daylight admission with environmental control.

### **Daylighting in Nigerian Educational Buildings**

Within the Nigerian context, research on educational buildings has largely examined classroom daylighting conditions, visual comfort, and environmental responsiveness of building design. Several studies report that many Nigerian classrooms rely primarily on side-lit window configurations without integrated shading devices or daylight modulation systems, resulting in uneven illuminance distribution and frequent glare conditions (Adebamowo, 2024; Ede, Ojelabi, and Ogedengbe, 2024; Oladapo and Ojo, 2022). Such conditions are associated with visual discomfort and increased dependence on artificial lighting.

Broader studies on Nigerian building technologies also emphasise the importance of climate-responsive design in improving environmental performance and occupant comfort. Studies examining sustainable construction materials and housing development patterns highlight how building envelope design and material selection influence indoor environmental conditions within Nigerian buildings (Ibitoye, Alagbe, and Dare-Abel, 2022; Ibitoye, Abiola, and Babamboni, 2023). These findings reinforce the need for environmentally responsive architectural strategies that regulate heat gain, daylight penetration, and overall indoor environmental quality.

Recent daylighting research further demonstrates that the incorporation of external shading devices, light shelves, and orientation-sensitive façade design can significantly improve daylight distribution and visual comfort in educational spaces (Ohochuku, Pepple, and Daminabo, 2025). However, limited architectural studies explicitly examine daylighting strategies in schools serving visually impaired pupils or evaluate these strategies through a sensory-inclusive design perspective within the Lagos context.

### **Policy and Regulatory Frameworks for Inclusive and Sustainable School Design**

Global policy frameworks emphasise the provision of inclusive, healthy, and sustainable learning environments. Sustainable Development Goal 4 advocates inclusive and equitable quality education, while Sustainable Development Goals 3 and 11 highlight the importance of environments that support health, well-being, and sustainable infrastructure (United Nations, 2021). These frameworks emphasise that educational environments should promote accessibility, safety, and well-being for all learners. The World Health Organization further highlights the importance of environmental conditions that support visual health and functional ability for individuals with visual impairment (World Health Organization, 2023). Within the Nigerian context, the Discrimination Against Persons with Disabilities (Prohibition) Act mandates accessibility in public buildings, including educational facilities (Federal Republic of Nigeria, 2018). However, while these policy frameworks establish broad accessibility requirements, they provide limited technical guidance on environmental parameters such as daylighting performance, glare control, and luminance uniformity in educational spaces.

Architectural research within Nigeria also emphasises the importance of contextual design considerations in shaping building form, spatial organisation, and environmental performance within the built environment (Ogunyemi, Iwaka, Adejumo, Adenubi, and Chukwuka, 2023). These perspectives highlight the need for architectural studies that translate policy objectives into practical design strategies capable of supporting inclusive and environmentally responsive learning environments.

### **Conceptual Framework**

The conceptual framework used in this study assumes that architectural daylighting strategies shape the lighting conditions experienced within classrooms, including illuminance adequacy, luminance uniformity, and glare conditions. These environmental parameters directly influence visual comfort within learning environments (Frontczak, Schiavon, Goins, Arens, Zhang, and Wargocki, 2020; Konis, Gamas, and Kensek, 2021; Mardaljevic, Brembilla, and Drosou, 2021). Within educational settings, visual comfort is an important determinant of reading performance, visual endurance, and mobility for pupils with visual impairments (Papadopoulos, Barouti, and Koustriava, 2020; Stringham, Garcia, and Smith, 2021; Bose, 2025). From a sensory-inclusive design perspective, visually stable and predictable lighting conditions support spatial orientation, reduce sensory overload, and promote equitable participation in learning activities (Poon, Wong, and Lam, 2022; Gaines, Bourne, Pearson, and Kleibrink, 2023). These considerations position visual comfort as a mediating factor through which architectural daylighting strategies influence the overall quality of learning environments for visually impaired pupils.

Studies examining organisational and institutional systems within Nigeria also demonstrate that governance structures and administrative processes influence the implementation of policies and operational frameworks across different sectors (Adesemowo, Dada, and Adegbe, 2022). Within the context of educational infrastructure, such institutional factors can shape how inclusive design policies and environmental performance strategies are translated into practical architectural outcomes. Accordingly, this study conceptualises sustainable daylighting strategies as architectural inputs that influence classroom lighting conditions, which in turn affect visual comfort and the effectiveness of sensory-inclusive learning environments for visually impaired pupils.

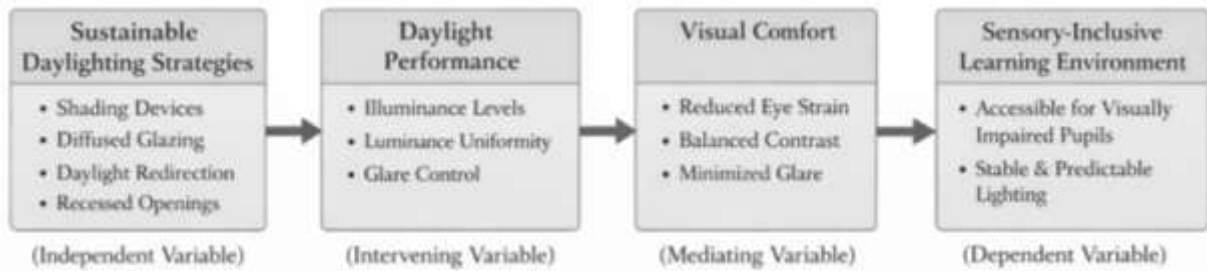


Fig 2.7: Conceptual Framework for Sustainable Daylighting and Sensory-Inclusive Environments

### Research Gap

Existing literature demonstrates that daylighting significantly influences visual comfort in schools and that visually impaired pupils have specific lighting requirements. Other studies highlight the importance of sensory-inclusive learning environments and climate-responsive daylighting strategies. However, very limited architectural research integrates these domains by evaluating sustainable daylighting strategies for sensory-inclusive learning environments serving visually impaired pupils within the Lagos context. This study addresses this gap by evaluating documented sustainable daylighting strategies and developing context-responsive design guidelines for inclusive secondary schools in Lagos.

### RESEARCH METHOD

This study adopts a qualitative, document-based analytical approach to examine sustainable daylighting strategies in inclusive secondary school environments. The research relies exclusively on peer-reviewed literature, published architectural case studies, and recognised lighting standards. No primary field measurements, simulations, or post-occupancy surveys were undertaken. Three case studies were purposively selected based on their relevance to education for visually impaired pupils and the availability of documented architectural information: Pacelli School for the Blind, Lagos, Nigeria; Singapore School for the Visually Handicapped, Singapore; and Hazelwood School, Glasgow, United Kingdom. Pacelli School provides local contextual grounding, while the international cases offer established references for daylight modulation and sensory-inclusive design.

Documented daylighting strategies were extracted from case descriptions and supporting literature and examined in relation to key daylight performance parameters identified in previous research, namely illuminance adequacy, luminance uniformity, and glare condition. These parameters were interpreted in relation to visual comfort requirements for visually impaired pupils and principles of sensory-inclusive design. A comparative analytical framework was employed to examine similarities and differences in the documented strategies across the selected cases. The analysis focused on design characteristics and intended performance rather than measured lighting values, ensuring consistency with the document-based methodology.

### RESULTS AND DISCUSSION

#### Visual Comfort Requirements for Visually Impaired Pupils

Synthesis of contemporary literature demonstrates strong consensus that effective learning environments for visually impaired pupils require lighting conditions characterised by adequate illuminance, controlled luminance contrast, glare mitigation, and stable light distribution. These parameters influence reading accuracy, visual endurance, mobility, and spatial orientation. Collectively, ten (10) out of twenty (20) reviewed studies indicate that lighting quality for visually impaired pupils extends beyond achieving sufficient brightness. Rather, effective environments must deliver visually stable and evenly distributed illumination while limiting glare and extreme luminance contrasts. These requirements form the evaluative basis for assessing sustainable daylighting strategies in the selected case studies.

Table 4.1: Visual Comfort Requirements for Visually Impaired Pupils from Reviewed Literature

Author(s)	Year	Key Finding	Design Implication
-----------	------	-------------	--------------------

Papadopoulos, Barouti, and Koustriava	2020	Higher illuminance improves reading performance	Provide illuminance above typical minimums
Stringham, Garcia, and Smith	2021	Reduced contrast sensitivity in low vision	Control luminance contrast
Bowers and Meek	2020	Glare degrades visual performance	Minimise direct and reflected glare
Legge, Bigelow, and Schuchard	2021	Lighting stability improves task persistence	Avoid abrupt brightness changes
Bose	2025	Uniform lighting enhances visual comfort	Promote luminance uniformity
Hasan and Sharmin	2025	Diffused daylight reduces discomfort and mobility issues	Prefer diffused daylight
Poon, Wong, and Lam	2022	Predictable sensory environments support engagement	Ensure visual predictability
Gaines, Bourne, Pearson, and Kleibrink	2023	Lighting affects spatial legibility	Support wayfinding
Barrett, Davies, Zhang, and Barrett	2020	Classroom design influences learning outcomes	Integrate lighting with spatial layout
Frontczak, Schiavon, Goins, Arens, Zhang, and Wargoeki	2020	Lighting strongly linked to occupant satisfaction	Treat lighting as core IEQ parameter
Ibitoye, Abiola, and Babamboni	2023	Sustainable construction technologies influence environmental performance and indoor comfort in Nigerian buildings	Climate-responsive design strategies should inform educational building design
Afolabi, Ibitoye, Grace and Olaoye	2025	Sustainable façade systems improve environmental performance in tropical urban environments	Integrate façade design strategies that regulate environmental conditions in educational buildings

### Documented Sustainable Daylighting Strategies in Selected Case Studies

#### Pacelli School for the Blind, Lagos

Available architectural descriptions and Nigerian classroom daylighting studies indicate that Pacelli School predominantly utilises conventional side-lit classroom configurations with operable windows and minimal façade articulation. Typical Nigerian school buildings of this typology rely on large window openings without integrated external shading or daylight redirection devices, a condition frequently observed in studies of Nigerian school architecture and building performance (Adebamowo, 2024; Ede, Ojelabi, and Ogedengbe, 2024; Ibitoye, 2025). Such configurations are commonly associated with over-illumination near window zones and inadequate daylight at room depth, resulting in uneven illuminance distribution and elevated glare probability. Further Nigerian investigations demonstrate that classrooms lacking shading devices and glazing control frequently experience poor luminance uniformity and increased glare exposure (Oladapo and Ojo, 2022; Adekunle and Nikolopoulou, 2021). The limited documentation of calibrated daylight modulation strategies at Pacelli School suggests that daylighting is provided primarily through opening area rather than as a deliberately controlled environmental system.



*Fig 4.1.1: Internal view of Pacelli School showing classroom layout*

*Source: (Ogunbodede, Okunola, Jobi, Oyedeji 2025).*



*Fig 4.1.2: External view of Pacelli School showing building mass and façade treatment*

*Source: (Ogunbodede, Okunola, Jobi, Oyedeji 2025).*

### **Singapore School for the Visually Handicapped (SSVH)**

Architectural documentation of SSVH describes a climate-responsive design approach incorporating deep overhangs, recessed window openings, and controlled glazing to moderate solar penetration. Classrooms are designed to admit predominantly diffused daylight, thereby limiting direct beam sunlight and reducing luminance contrast. Tropical educational buildings employing similar strategies demonstrate significant reductions in glare probability and improved daylight uniformity (Lim and Heng, 2020; Hiyama, Wen, and Tanaka, 2021). SSVH further integrates orientation-sensitive façade design and daylight redirection elements to enhance daylight penetration into deeper classroom zones (Konis, Gamas, and Kensek, 2021). These strategies illustrate deliberate modulation of daylight rather than maximisation of window area.



*Fig 4.1.3: External view of SSVH showing building mass, façade treatment and window placement*

*Source: mycommunityfestival.sg*

#### **Hazelwood School, Glasgow**

Hazelwood School is widely documented as a sensory-inclusive design benchmark characterised by controlled apertures, diffused roof lighting, and careful daylight modulation. The use of high-level glazing and indirect daylight admission contributes to visually calm interior environments with minimal glare and stable luminance distribution (Gaines, Bourne, Pearson, and Kleibrink, 2023). Research on sensory-inclusive schools employing comparable strategies indicates that controlled daylighting enhances spatial legibility and reduces sensory overload (Poon, Wong, and Lam, 2022). Hazelwood therefore exemplifies daylighting as an intentionally calibrated sensory design tool.



*Fig 4.1.4: External view of Hazelwood School showing building mass, façade treatment and window placement*

*Source: Architizer project page*



Fig 4.1.5: Internal view of Hazelwood School showing daylighting and interior volume.

Source: Architizer project page

**Table 4.2: Comparative Matrix of Documented Daylighting Strategies**

Strategy	Pacelli (Lagos)	SSVH (Singapore)	Hazelwood (UK)	Visual Comfort Benefit
External shading	Not documented	Present	Present	Glare reduction
Recessed openings	Not documented	Present	Present	Luminance control
Diffused daylight	Limited	Present	Present	Visual stability
Daylight redirection	Not documented	Present	Present	Improved uniformity
Orientation-sensitive façade	Not documented	Present	Present	Balanced daylight

#### Relationship Between Sustainable Daylighting Strategies and Visual Comfort

Comparison of the case studies indicates a clear relationship between daylighting strategies and visual conditions in learning environments. Classrooms incorporating external shading, diffused glazing, recessed openings, and daylight redirection elements demonstrate improved control of luminance contrast and reduced glare exposure, resulting in more evenly distributed illumination.

Conversely, reliance on conventional side-lit window configurations without modulation is associated with excessive brightness near openings and insufficient illumination at room depth. These conditions produce abrupt luminance transitions and elevated glare potential, which undermine visual comfort and visual endurance for visually impaired pupils. The findings suggest that well-designed daylighting strategies can support accessibility by helping control how light enters and spreads within learning spaces, extending their role beyond passive energy reduction to shaping visually stable learning environments.

#### Implications for Sensory-Inclusive Learning Environments

Learning environments in which daylight is deliberately modulated through shading, diffused glazing, and controlled apertures exhibit more stable and predictable visual conditions. Such environments minimise abrupt luminance transitions and reduce glare exposure, supporting visual calmness, spatial orientation, and sustained engagement. In contrast, conventional daylighting configurations without

modulation are more likely to generate uneven brightness and visual instability, which may contribute to discomfort and reduced task persistence among visually impaired pupils. The limited integration of calibrated daylighting strategies in Lagos-based school typologies therefore suggests that sensory inclusion is not yet systematically embedded within classroom lighting design.

#### **Derived Sustainable Daylighting Design Guidelines**

1. External shading devices such as overhangs, fins, or louvers should be provided at classroom openings to block direct sunlight and reduce glare.
2. Glazing should allow diffused daylight and limit excessive brightness in order to reduce luminance contrast and eye strain.
3. Daylight redirection elements such as light shelves, reflective ceilings, or high-level glazing should be used to improve light distribution across classroom depth.
4. Façade orientation should favour north–south openings where possible, with careful treatment of east–west façades to limit low-angle sun and glare.
5. Daylighting should be combined with artificial lighting and simple control systems to maintain stable lighting levels throughout the day.

### **CONCLUSION**

The research explored how sustainable daylighting strategies affect sensory-inclusive learning environments for visually impaired pupils in Lagos secondary schools. The findings show that visually impaired pupils require classrooms with adequate illuminance, uniform light distribution, and effective glare control. These conditions support reading, visual endurance, and spatial orientation. International case studies demonstrate that external shading, diffused glazing, recessed openings, and daylight redirection systems help achieve more even lighting and lower glare. In contrast, many Lagos school buildings depend mainly on side windows with little daylight control, which can result in uneven illumination and glare. Sustainable daylighting supports both energy efficiency and accessibility when carefully designed to control light entry and distribution. The proposed design guidelines provide a basis for improving sensory-inclusive secondary school design in Lagos.

### **RECOMMENDATIONS**

1. Educational authorities should adopt performance-based daylighting criteria for schools serving visually impaired pupils, focusing on illuminance levels, luminance uniformity, and glare control.
2. Sensory-inclusive daylighting considerations should be included in school design briefs, approval procedures, and refurbishment guidelines.
3. Architects, lighting specialists, and special-education professionals should collaborate during school planning and design.
4. Architectural education and professional training programmes should place greater emphasis on climate-responsive and sensory-inclusive daylighting design.
5. Professional bodies and government agencies should develop local technical guidance that translates accessibility policies into practical daylighting design parameters.

Overall, these recommendations aim to translate established visual comfort requirements and sensory-inclusive principles into practical, climate-responsive daylighting strategies that promote visually stable, glare-controlled, and accessible learning environments for visually impaired pupils in Lagos secondary schools.

Future research should incorporate daylight simulation modelling and post-occupancy evaluation to quantitatively assess the performance of the proposed strategies within operational school environments. Investigations that include user-based assessments from visually impaired pupils and educators would provide further insight into how calibrated daylighting influences reading performance, mobility, and classroom engagement. Expanding the scope of analysis to additional Nigerian school

typologies and climatic sub-regions would also support the development of broader evidence-based daylighting guidelines for inclusive educational design.

## REFERENCES

- Acosta, I., Campano, M. A., Molina, J. F., & Domínguez-Amarillo, S. (2021). Daylighting design for classrooms in Mediterranean climates: A systematic review. *Energy and Buildings*, 232, 110603.
- Adebamowo, M. A. (2024). Daylighting performance of public secondary school classrooms in southwestern Nigeria. *Journal of Building Performance*, 15(2), 45–59.
- Adekunle, T. O., & Nikolopoulou, M. (2021). Daylighting performance and visual comfort in Nigerian school classrooms. *Building and Environment*, 195, 107750.
- Adesemowo, M. M., Dada, O. S., & Adegbe, F. F. (2022). *Tax administration and voluntary compliance: A study of selected state internal revenue service in South-West Nigeria*.
- Afolabi, T. A., Ibitoye, O. A., Grace, K. C., & Olaoye, G. (2025). *Green facade systems as a sustainable solution for urban heat island mitigation in Lagos State*.
- Al-Tamimi, N. A., & Fadzil, S. F. S. (2021). The potential of shading devices for improving daylight performance in classrooms. *Energy and Buildings*, 231, 110607
- Barrett, P., Davies, F., Zhang, Y., & Barrett, L. (2020). The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis. *Building and Environment*, 89, 118–133.
- Bose, S. (2025). Lighting design for children with visual impairment: A review of visual comfort requirements. *Journal of Visual Impairment & Blindness*, 119(1), 32–45.
- Bowers, A. R., & Meek, C. (2020). Visual performance and glare in individuals with low vision. *Optometry and Vision Science*, 97(5), 370–377.
- Ede, A. N., Ojelabi, R. A., & Ogedengbe, O. (2024). Assessment of daylighting and glare in Nigerian classroom buildings. *Nigerian Journal of Environmental Design*, 19(1), 21–34.
- Federal Republic of Nigeria. (2018). *Discrimination against persons with disabilities (prohibition) act*. Government Press.
- Frontczak, M., Schiavon, S., Goins, J., Arens, E., Zhang, H., & Wargocki, P. (2020). Quantitative relationships between occupant satisfaction and building design parameters. *Building and Environment*, 135, 127–145.
- Gaines, K., Bourne, A., Pearson, M., & Kleibrink, M. (2023). Designing sensory-inclusive learning environments. *Journal of Learning Spaces*, 12(1), 1–15.
- Haddad, S., & Li, D. H. W. (2023). Daylighting performance of advanced façade systems in educational buildings. *Energy and Buildings*, 278, 112593.
- Hasan, M., & Sharmin, T. (2025). Effects of diffused daylight on visual comfort and mobility of visually impaired students. *Journal of Architectural Research*, 29(1), 65–78.
- Hiyama, K., Wen, J., & Tanaka, H. (2021). Glare control and daylight utilization in tropical school buildings. *Building and Environment*, 193, 107645.
- Ibitoye, O. A. (2025). *A critical analysis of interlocking stabilized soil blocks in residential architecture: A case study of Obayemi House, Redemption Camp, Ogun State*.
- Ibitoye, O. A., Abiola, O. A., & Babamboni, A. S. (2023). *Demographic characteristics of housing estates developed with ISSB technology in selected southwestern Nigerian cities*.
- Ibitoye, O. A., Alagbe, O., & Dare-Abel, O. (2022.). *Comparative cost advantages of interlocking stabilized soil block and sandcrete block for building construction in South-West Nigeria*.
- Konis, K., Gamas, A., & Kensek, K. (2021). Passive daylighting design and simulation for high-performance classrooms. *Building and Environment*, 188, 107444.
- Legge, G. E., Bigelow, C. A., & Schuchard, R. A. (2021). Low vision and reading performance. *Vision Research*, 181, 19–27.
- Li, D. H. W., Wong, S. L., Tsang, E. K. W., & Cheung, G. H. W. (2020). A review of daylighting performance and design in buildings. *Renewable and Sustainable Energy Reviews*, 133, 110109.
- Lim, Y. W., & Heng, C. Y. S. (2020). Dynamic façade shading and daylight performance in tropical classrooms. *Energy and Buildings*, 215, 109890.
- Mardaljevic, J., Brembilla, E., & Drosou, N. (2021). Daylight metrics for classroom performance evaluation. *Building and Environment*, 191, 107592.

- Mostafa, M. (2020). Architecture for autism: Autism ASPECTSS™ in school design. *Archnet-IJAR*, 14(1), 1–22.
- Nguyen, A. T., Reiter, S., & Rigo, P. (2020). A review on simulation-based optimisation methods applied to building performance analysis. *Applied Energy*, 113, 1043–1058.
- Ogunbodede, Bolawole & Okunola, Segun & Jobi, Akinfolarin & Oyedeji, Jesufolahanmi. (2025). Inclusive Architecture for Individuals with Visual Impairments: A Study of Pacelli School for the Blind and Partially Sighted in Surulere, Lagos, Nigeria. *Journal of Engineering*. 31. 1-19. 10.31026/j.eng.2025.11.01.
- Ogunyemi, O. G., Iweka, A., Adejumo, T., Adenubi, O. O., & Chukwuka, O. P. (2023.). *Symbolic forms in church architecture: A case study of Saint Augustine Catholic Church Ikorodu, Lagos State*.
- Ohochuku, A. E., Pepple, T. F., & Daminabo, F. (2025). Evaluation of shading devices and light shelves in tropical classroom buildings. *Journal of Building Performance Simulation*, 18(2), 141–156
- Oladapo, A. A., & Ojo, O. (2022). Visual comfort assessment of Nigerian classrooms. *Journal of Sustainable Architecture*, 7(1), 33–46.
- Opitz, D. L. (2022). Sensory-friendly schools: A design framework. *Journal of Special Education Facilities*, 5(2), 15–28.
- Papadopoulos, K., Barouti, M., & Koustriava, E. (2020). Lighting conditions and reading performance of students with low vision. *British Journal of Visual Impairment*, 38(1), 52–63.
- Poon, K. K., Wong, M. E., & Lam, W. M. (2022). Sensory processing and classroom environment. *International Journal of Inclusive Education*, 26(6), 601–618.
- Stringham, J. M., Garcia, P. V., & Smith, P. A. (2021). Visual comfort and contrast sensitivity in low vision. *Investigative Ophthalmology & Visual Science*, 62(3), 14–22.
- United Nations. (2021). *The sustainable development goals report 2021*. UN Publications.
- World Health Organization. (2023). *World report on vision*. WHO Press.