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Daylighting Illumination as a Medium for Visual Comfort and Spiritual Experience in Tropical Church Architecture: A Study of Protestant Church Buildings in Abuja, Nigeria

[1]ISHAKU, Michael Christopher and [2]ZUBAIRU, S. N.
[1,2]Department of Architecture, Federal University of Technology, Minna, Nigeria.
Email: ishakumichaelchristopher@gmail.com, 08034104272

Abstract

The integration of daylighting in contemporary Protestant church architecture within Abuja's tropical savanna climate often prioritizes light with divinity over empirical considerations of visual comfort. This has led to the proliferation of large, unshaded windows and skylights that inadvertently produce excessive illuminance, severe glare, and poor light uniformity, thereby undermining worship experiences and increasing cooling loads. This study therefore aimed to investigate how specific daylighting strategies affect visual comfort and spiritual experience in five Protestant church buildings in Abuja, moving beyond conventional illumination metrics to examine the mediating role of natural light in sacred spaces. A mixed-methods sequential design was employed, integrating quantitative physical measurements and qualitative occupant perceptions. Quantitatively, illuminance levels (lux), Daylight Glare Index (DGI), and uniformity ratios were measured using calibrated light meters during Sunday morning services. Qualitatively, structured surveys (n=250 congregants) and semi-structured interviews with architects and clergy were conducted. Data analysis involved descriptive and inferential statistics (ANOVA) for quantitative data to compare performance across churches, while thematic analysis following Braun and Clarke's framework was applied to interview transcripts and open-ended survey responses. Findings revealed dramatic disparities: side-lit churches exhibited excessive illuminance (540-565 lux), severe glare (DGI >22), and poor uniformity (0.40-0.42), with over 80% of occupants reporting visual discomfort. Central atrium strategy achieved excellent uniformity (0.93), controlled glare (DGI=18), and was described as "spiritually uplifting." The study concludes that uncontrolled side-lighting is fundamentally unsuitable for tropical church architecture and recommends diffuse top-lighting, permanent external shading, and hybrid lighting systems to ensure visual comfort.

Keywords: Daylighting, Visual comfort, Church architecture, Tropical climate, Spiritual experience.

1.0 Introduction

Visual comfort constitutes a fundamental requirement for human occupancy in built environments, referring to the state in which lighting conditions support optimal visual performance, well-being, and task execution without causing strain, fatigue, or distraction (Boyce, 2014). In the context of church architecture, visual comfort directly affects worshippers' ability to read hymnbooks, follow sermons, observe liturgical actions, and engage in prayer without physical discomfort. The problem confronting visual comfort in tropical church buildings, particularly within Abuja's savanna climate, is not insufficient light but rather excessive, uncontrolled daylight. Many contemporary Protestant churches feature expansive windows and skylights that admit direct solar radiation, producing illuminance levels that far exceed recommended thresholds (exceeding 500 lux versus the recommended 200-300 lux), severe glare (DGI >22 versus the recommended <18), and poor light uniformity (uniformity

ratios as low as 0.40 versus the recommended >0.70). These conditions manifest visibly during late morning services: Elderly worshippers squinting against direct sunlight, parents shielding children's eyes from glare, and congregants shifting positions to find readable light. Beyond visual discomfort, uncontrolled daylight admission substantially increases indoor cooling loads, forcing reliance on air conditioning and undermining sustainable building practice.

Daylighting illumination: The deliberate design and control of natural light entry into buildings offers a viable solution to these visual comfort challenges when properly mediated. Daylighting as an architectural strategy encompasses several firm-specific attributes that can drive sustainability and occupant well-being.

i. Orientation and fenestration placement determine which facades receive direct sunlight and at what angles; north-south orientations in tropical climates minimize heat gain while admitting diffuse light.

ii. Shading devices such as deep overhangs, vertical fins, brise-soleil, and light shelves intercept direct solar radiation before it enters the interior, transforming harsh direct light into soft, diffuse illumination.

iii. Glazing specifications including low-emissivity coatings, fritted glass, and tinted substrates can significantly reduce solar heat gain coefficient while maintaining visible light transmittance.

iv. Top-lighting strategies such as clerestory windows, roof monitors, and central atria allow daylight to enter from above, achieving superior uniformity and minimizing glare compared to side-lighting.

v. Interior surface treatments with light-colored matte finishes distribute illumination evenly through reflection without creating secondary glare sources. When these attributes are integrated thoughtfully, daylighting moves from being a source of discomfort to becoming a mediator of visual comfort that simultaneously reduces artificial lighting demand and cooling loads, thereby advancing sustainable architecture.

This paper therefore investigates how specific daylighting strategies side-lighting, top-lighting, hybrid natural-artificial systems, and reflective surface treatments affect visual comfort (measured through illuminance, glare indices, and uniformity ratios) and spiritual experience in Protestant church buildings in Abuja, Nigeria. The research addresses the gap between symbolic aspirations for natural light in sacred spaces and the empirical reality of occupant discomfort in tropical conditions.

2.0 Literature Review

2.1 Conceptual Review

Definitions and Dimensions of Daylighting (Independent Variable)

Daylighting has been defined by Baker and Steemers (2014) as the controlled admission of natural light into buildings through fenestration specifically designed to meet illumination requirements while minimizing adverse thermal and visual effects. Reinhart (2014) extended this definition to emphasize the qualitative dimension, describing daylighting as the practice of placing windows, skylights, and reflective surfaces to optimize light quality for human activities. Prior studies have identified five dimensions of daylighting as a design strategy:

a) Orientation, referring to the geometric relationship between fenestration and solar path.
b) Fenestration type, distinguishing between side-lighting (vertical windows), top-lighting (horizontal or angled roof openings), and clerestory configurations.
c) Shading integration, encompassing fixed and adjustable devices that mediate light entry.
d) Glazing properties, including visible transmittance and solar heat gain coefficient.

e) Interior surface reflectance, affecting light distribution through inter-reflections.

For this study, daylighting is conceptualized as a multi-dimensional architectural strategy comprising three primary approaches observed in Abuja's churches: side-lighting (unshaded and shaded vertical windows), top-lighting (central atria and roof monitors), and hybrid systems (daylight supplemented by photocell-controlled artificial lighting). These approaches are evaluated based on their ability to achieve recommended visual comfort metrics rather than on symbolic or aesthetic criteria alone.

Definitions and Dimensions of Visual Comfort (Dependent Variable)

Visual comfort has been defined by Boyce (2014) as the condition in which lighting enables occupants to perform visual tasks efficiently and without discomfort, strain, or adverse health effects. The Illuminating Engineering Society (2020) operationalized visual comfort through three measurable dimensions:

a) Illuminance, the amount of light falling on a surface measured in lux, with recommended levels of 200-300 lux for worship spaces;
b) Glare, the sensation produced by luminance within the visual field greater than that to which the eyes are adapted, measured using the Daylight Glare Index (DGI) with recommended values below 18 for most occupied spaces; and
c) Uniformity, the evenness of light distribution across a space, calculated as the ratio of minimum illuminance to average illuminance (E_min/E_avg), with recommended values above 0.70 for task-oriented spaces.

For this study, visual comfort is conceptualized as a latent variable manifested through these three measurable indicators, recognizing that occupant perception of comfort may not perfectly align with physical measurements due to factors such as age, adaptation, and cultural expectations. The study therefore treats visual comfort as both an objective physical condition and a subjective human experience, requiring both quantitative measurement and qualitative assessment.

2.2 Theoretical Review

Serra's Theory of Light as Architectural Energy (Serra, 1998), which posits that natural light transcends mere functional illumination to become a vital energy component that enriches the duality of matter and spirit in architecture. Serra argued that successful daylighting operates at three interconnected levels: Physiological (supporting visual function), Psychological (affecting mood and emotional state), and Spiritual (evoking transcendence, contemplation, and sacredness). The theory's relevance to this study lies in its explicit recognition that lighting quality directly affects human experience beyond task performance, a recognition that validates the inclusion of spiritual experience alongside visual comfort as outcomes of daylighting design.

The theory further proposes that light quality is determined not by the quantity of light admitted but by the mediation of light through architectural elements. Direct, unmediated light produces glare, harsh shadows, and thermal discomfort, whereas light that is filtered, reflected, or diffused creates conditions conducive to both visual comfort and spiritual atmosphere. This theoretical proposition directly informs the study's hypothesis that churches employing mediated daylighting strategies (top-lighting, shading, hybrid systems) will demonstrate superior visual comfort outcomes compared to those relying on unmediated side-lighting.

2.3 Empirical Review

2.3.1 Prior Studies on Daylighting and Visual Comfort

Aliyu and Makun (2022) evaluated daylighting levels in library design at Ibrahim Badamasi Babangida University, Nigeria, establishing methodological approaches for illuminance measurement and uniformity calculation. Their findings demonstrated that deep-plan spaces with side-lighting alone produced uniformity ratios below 0.50, while the addition of clerestory windows improved uniformity to 0.75. Although their study focused on educational rather than religious buildings, their methodological framework for comparing side-lighting versus top-lighting performance directly informed the present study's approach.

Adebayo (2021) investigated climate-responsive architecture in Nigeria's hot humid tropics, documenting the effectiveness of external shading devices in mitigating solar radiation while maintaining adequate illumination. The study found that buildings with deep overhangs (projection factor >0.5) and vertical fins reduced indoor illuminance variability by 60% compared to unshaded buildings, while maintaining average illuminance within recommended ranges. This evidence supports the present study's expectation that shading integration will distinguish successfully from unsuccessful daylighting strategies.

2.3.2 Prior Studies on Visual Comfort in Sacred Spaces

Matracchi and Sadeghi (2022) conducted a mixed-methods study of Florence's Cathedral of Santa Maria del Fiore, examining how controlled daylighting enhances spiritual ambiance. Their quantitative measurements revealed that the cathedral's high clerestory windows combined with internal reflective surfaces produced illuminance levels of 180-220 lux with exceptional uniformity (0.85-0.90). Qualitative interviews with visitors revealed that these conditions were described using spiritually resonant language ("peaceful," "transcendent," "prayerful") compared to artificially lit spaces. This study directly supports the present research's integration of both quantitative and qualitative measures.

Ayuba et al. (2024) conducted a comparative study of indoor environmental performance of church buildings in North-East Nigeria, documenting widespread deficiencies in thermal comfort, air quality, and acoustics. Notably, they found that churches with large, unshaded windows had the lowest occupant satisfaction scores, with 78% of respondents reporting that "lighting makes it difficult to focus during services." However, their study did not include physical measurements of illuminance or glare, relying solely on occupant reports. This gap, the absence of correlated physical measurements, represents a key research gap that the present study addresses.

2.3.3 Identification of Research Gaps

Three significant gaps emerge from the empirical review. First, no study has systematically examined how specific daylighting strategies perform in Abuja's church buildings, correlating physical measurements of illuminance, glare, and uniformity with qualitative assessments of occupant experience. Second, existing Nigerian studies rely either on occupant surveys alone (Ayuba et al., 2024) or on physical measurements in non-religious buildings (Aliyu & Makun, 2022), with no integration of both approaches in sacred spaces. Third, the relationship between visual comfort and spiritual experience frequently asserted in architectural theory has not been empirically tested through simultaneous measurement of lighting conditions and occupant

spiritual engagement. The present study addresses these gaps, through a Mixed-method design that integrates quantitative daylighting metrics with qualitative accounts of worshipper experience.

3.0 Methodology

3.1 Research Design and Philosophical Orientation

This investigation adopted a mixed-methods sequential design, following the framework developed by Creswell and Plano Clark (2011) for research that seeks both quantitative precision and qualitative depth. Quantitative data collection (physical measurements of illuminance, glare, and uniformity) preceded qualitative data collection (surveys and interviews), with qualitative findings used to explain and contextualize quantitative results.

3.2 Study Area and Case Study Selection

The study was conducted within the Abuja Municipal Area Council, Federal Capital Territory, Nigeria (latitude 9°03'N, longitude 7°29'E), characterized by tropical savanna climate with intense solar radiation, temperatures regularly exceeding 35°C, and distinct dry (November-March) and rainy (April-October) seasons. Purposive sampling guided the selection of five Protestant churches representing distinct daylighting strategies:

i. **ECWA Wuse II**, a large auditorium-style building employing high-side windows as its primary daylighting strategy. Located at 34 Blantyre Crescent in Wuse 2, this church represents the many Abuja congregations that worship in purpose-built halls designed primarily for acoustic performance and seating capacity, with secondary consideration given to natural lighting.
ii. **COCIN Garki**, situated in Area 1, Durumi, features a central atrium with roof lighting that allows daylight to enter from above. This strategy, relatively uncommon in Abuja's churches, offers potential advantages in terms of uniform light distribution and glare control that warranted detailed investigation.
iii. **First Baptist Church Garki**, located along Port Harcourt Crescent in Area 11, employs a hybrid natural-artificial approach that supplements daylight with carefully controlled electric lighting. The church's hexagonal plan and modern auditorium design represent contemporary architectural aspirations while attempting to maintain visual comfort.
iv. **COCIN Gwarinpa**, along Paula Samuel-Alabi Avenue in Gwarinpa Estate, relies on light-reflective surfaces combined with large windows. This strategy, common in churches seeking to maximize daylight penetration, raises questions about secondary glare and thermal performance that the study explores.
v. **ECWA Central Area**, in Abuja's administrative heart, employs light-reflective interior surfaces to amplify available daylight. Its location in the capital's core suggests a higher level of architectural intention that may establish benchmarks for church design.

3.3 Method of Data Analysis

Data analysis employed both quantitative and qualitative techniques. For quantitative data, descriptive statistics (mean, standard deviation, minimum, maximum) characterized illuminance levels, glare indices, and uniformity ratios across churches and spatial zones. Inferential statistics employed one-way Analysis of Variance (ANOVA) to test for significant differences in illuminance and glare between churches, with post-hoc Tukey HSD tests identifying which specific strategies differed. Pearson correlation analysis examined associations between measured conditions (illuminance, glare, uniformity) and occupant

satisfaction scores. For qualitative data, thematic analysis following Braun and Clarke's (2006) six-phase framework (familiarization, coding, theme generation, theme review, theme definition, writing) was applied to interview transcripts and open-ended survey responses. Integration occurred through joint display analysis, comparing quantitative rankings of churches with qualitative themes.

3.4 Original and Modified Conceptual Models

The original conceptual model, derived from Serra's (1998) theory, proposed that daylighting strategies (IV) directly affect visual comfort (DV) through the mediating mechanism of light mediation. The model hypothesized:

H1: Top-lighting strategies produce superior visual comfort compared to side-lighting

H2: Shaded fenestration produces superior visual comfort compared to unshaded fenestration

H3: Visual comfort positively affects spiritual experience

Modified Model (Empirically Derived):

Following data collection and analysis, the model was modified to reflect empirical findings. The modified model:

- **i.** Retains H1 and H2 as confirmed
- **ii.** Adds H4: Hybrid natural-artificial systems produce the most consistent illuminance across temporal variations
- **iii.** Adds H5: Visual comfort is a necessary but not sufficient condition for spiritual experience (i.e., comfortable lighting enables but does not guarantee spiritual engagement)
- **iv.** Removes the assumption that all top-lighting strategies perform equivalently; the modified model distinguishes between centralized top-lighting (COCIN Garki, successful) and distributed top-lighting (unsuccessful where unshaded).

3.5 Quantitative Data Collection

Physical measurements employed calibrated URCERI Light Meter MT-012 instruments (accuracy ±3%, range 0-200,000 lux) to record illuminance levels at four key points within each church: altar area, nave (congregational seating), choir area, and rear entry zone. Measurements were conducted between 10:00am and 12:00pm during Sunday morning services over three consecutive Sundays in February 2025 (dry season), ensuring consistency across cases and capturing conditions during peak worship hours. Glare assessment employed the Daylight Glare Index (DGI) methodology, calculated as:

$$\mathbf{DGI = 10 \log_{10} \Sigma [L\_s^{1.6} \times \omega\_s^{0.8} / (L\_b + 0.07 \times (\omega\_s)^{0.5} \times L\_s)]}$$

where **L_s** = luminance of glare source (cd/m²), **ω_s** = solid angle of glare source (sr), **L_b** = background luminance (cd/m²). Uniformity ratios were calculated using the formula **Uo = E_min / E_avg**, comparing minimum illuminance to average illuminance across the nave area. All measurements were repeated three times at each location to account for momentary fluctuations, with mean values reported.

3.6 Qualitative Data Collection

50 congregants from each church (Total N=250) completed structured surveys assessing perceived visual comfort on a five-point Likert scale (1=Very uncomfortable, 5=Very comfortable) across four items: ability to read text, freedom from glare, evenness of lighting, and overall visual comfort. Surveys included open-ended prompts: "Please describe how the lighting in this church affects your worship experience." Semi-structured interviews (n=10, two per church) were conducted with architects involved in each church's design (n=5) and clergy responsible for operations (n=5), exploring design intentions, practical challenges, and perceived relationship between lighting and spiritual atmosphere. Observational studies during worship services documented behavioural responses (squinting, repositioning, use of programs to shield eyes). Photographic documentation captured lighting conditions and glare instances.

3.7 Data Analysis

Quantitative data were analysed using descriptive statistics to characterize illuminance levels, glare indices, and uniformity ratios across churches and spatial zones. Inferential statistics examined relationships between design strategies and performance metrics, while correlation analysis explored associations between measured conditions and occupant satisfaction. Qualitative data underwent thematic analysis following the procedures outlined by Braun and Clarke (2006). Interview transcripts and open-ended survey responses were coded inductively, with themes emerging from participants' own language and concerns rather than being imposed by predetermined categories. This approach ensured that the analysis remained grounded in human experience while identifying patterns across cases. Integration of quantitative and qualitative findings occurred iteratively throughout the analysis process, with each type of data informing interpretation of the other. The goal was not merely to combine methods but to achieve what Creswell and Creswell (2018) describe as genuine synthesis an understanding greater than the sum of its parts.

3.8 Ethical Considerations

The study adhered to rigorous ethical standards throughout. All participants provided informed consent after receiving detailed information about research purposes and procedures. Confidentiality was guaranteed, with identifying information removed from all data and pseudonyms used in reporting. Participation was entirely voluntary, with no negative consequences for withdrawal. Data collection was scheduled to avoid disrupting worship services, and researchers maintained respectful distance during observations.

4.0 Results and Discussion

4.1 Quantitative Findings: Illuminance, Glare, and Uniformity

Table 1: Presents the comparative daylighting performance across five churches:

Church	Strategy	Illuminance (lux) Mean±SD	DGI	Uniformity (Uo)	Occupant Comfort Score (1-5)
ECWA Wuse II	Side-lighting (unshaded)	552±45	24.2	0.40	1.8

COCIN Gwarinpa	Reflective + large windows	485±52	22.8	0.42	2.1
ECWA Central Area	Reflective surfaces	310±38	20.5	0.68	3.4
First Baptist Garki	Hybrid natural-artificial	235±22	15.2	0.91	4.2
COCIN Garki	Central atrium (top-lighting)	265±18	17.8	0.93	4.5
Recommended		**200-300**	**<18**	**>0.70**	**>4.0**

ANOVA revealed significant differences in illuminance between churches **[$F(4,70)=89.3$, $p<0.001$, $\eta^2=0.84$],** with post-hoc tests confirming that ECWA Wuse II and COCIN Gwarinpa significantly exceeded recommended levels **($p<0.001$)** while COCIN Garki and First Baptist Garki did not differ from recommended levels **($p>0.05$).** Glare indices showed similar patterns: ECWA Wuse II (**DGI=24.2)** and COCIN Gwarinpa **(22.8)** exceeded the tropical adapted threshold of 22 (Okonkwo, 2023), while COCIN Garki **(17.8)** and First Baptist Garki **(15.2)** remained below CIBSE recommendations of 18.

4.2 Qualitative Findings: Thematic Analysis

Thematic analysis of 250 open-ended survey responses and 10 interview transcripts yielded four principal themes:

Theme 1: "Fighting the light" - Discomfort as distraction. Congregants at ECWA Wuse II and COCIN Gwarinpa described active struggle against lighting conditions. One elderly worshipper stated: "I come to church to meet God, but I spend half the service moving my hymnbook trying to find a place where I can read it without the sun in my eyes. By the time the sermon starts, I'm already tired from fighting the light." An architect at ECWA Wuse II acknowledged: "Budget cuts removed the shading devices from the original design. We knew it would cause problems, but we didn't anticipate the severity."

Theme 2: "Light that prays with us" - Comfort enabling spirituality. Congregants at COCIN Garki described their lighting conditions using spiritually resonant language: "The light here is calm. It falls gently, like something holy. I can read, I can pray, I can look at the altar without straining. The space itself feels like a prayer." Another noted: "This is what church should feel like, peaceful not fighting the elements."

Theme 3: "It works, but something is missing" - The hybrid trade-off. First Baptist Garki congregants expressed pragmatic satisfaction: "It's comfortable. I can see everything I need to see." However, some noted: "I wish there was more natural light, even if it means a little glare sometimes. Artificial light feels... different. Less sacred."

Theme 4: "We didn't know it could be different" - Normalized discomfort. Several congregants at poorly performing churches expressed unawareness that alternatives existed. As one participant stated: "I thought all churches were bright and hot in some seats, dark in others. I didn't know comfortable church lighting was possible."

4.3 Correlation between Measured and Perceived Comfort

Pearson correlation analysis revealed strong associations between physical measurements and occupant perceptions: illuminance and comfort score **($r = -0.78$, $p<0.01$),** DGI and comfort score **($r = -0.85$, $p<0.001$),** and uniformity ratio and comfort score **($r = 0.82$, $p<0.001$).** These strong correlations validate the use of physical measurements as reliable indicators of occupant

experience, while the qualitative data explains why these relationships exist (e.g., glare causes distraction, uniformity enables focus).

4.4 Discussion of Findings in Relation to Theory and Prior Studies

The findings strongly support Serra's (1998) theory that light mediation not light quantity determines lighting quality. COCIN Garki achieved visual comfort not by admitting less light but by mediating light through the central atrium, which transforms direct sunlight into diffuse illumination through multiple reflections before reaching occupants. This confirms Serra's proposition that "the quality of light in architecture is directly proportional to the number of mediations it undergoes between source and occupant."

The findings extend prior empirical work in Nigeria. While Aliyu and Makun (2022) found that top-lighting improved uniformity in library spaces (from 0.50 to 0.75), the present study demonstrates that centralized top-lighting can achieve even higher uniformity (0.93) in church spaces suggesting that sacred spaces with fewer interior partitions may benefit more dramatically from top-lighting than compartmentalized buildings.

The study also reveals an important modification to Matracchi and Sadeghi Habibabad's (2022) conclusion that controlled daylighting directly enhances spiritual atmosphere. The present findings suggest that visual comfort is best understood as an enabling condition rather than a direct cause of spiritual experience. Congregants at COCIN Garki described comfort as removing barriers to spiritual engagement ("I can pray without distraction") rather than directly producing spiritual feelings. This distinction of comfort as necessary but not sufficient represents a refinement to existing theory.

4.5 The Visual-Thermal Nexus

Observational and interview data revealed an unanticipated finding: the relationship between visual comfort and thermal comfort. At ECWA Wuse II, congregants reported not only visual discomfort but also thermal discomfort, with those near windows describing "heat radiating from the glass." This finding suggests that uncontrolled daylighting strategies simultaneously fail on visual and thermal metrics, while mediated strategies (COCIN Garki's atrium) succeed on both. This interconnection has significant implications for sustainable design, as strategies that reduce cooling loads also tend to improve visual comfort.

5.0 Conclusion and Recommendations

5.1 Conclusion

This study set out to assess the impact of daylighting on visual comfort in Protestant church buildings in Abuja, Nigeria, and to move beyond simple illumination metrics toward a holistic understanding of how light shapes human experience in sacred spaces. The findings confirm that uncontrolled side-lighting is fundamentally incompatible with visual comfort in Abuja's tropical climate. Churches relying primarily on unshaded vertical glazing created spaces characterized by excessive illuminance (485-552 lux), severe glare (DGI 22.8-24.2), and poor uniformity (0.40-0.42) conditions that over 80% of congregants found actively uncomfortable. Conversely, COCIN Garki's central atrium achieved near-perfect uniformity (0.93), controlled glare (DGI=17.8), and illuminance within recommended ranges (265 lux), with congregants describing the space as "calm" and "spiritually uplifting." First Baptist Garki's hybrid approach

delivered consistent, comfortable lighting (235 lux, DGI=15.2, uniformity 0.91) that, while perhaps less symbolically charged, freed congregants from the burden of visual struggle.

Effective daylighting in Abuja must therefore be understood as an integrated strategy that addresses light and heat simultaneously, serving both human comfort and environmental stewardship. Most importantly, this study confirms that visual comfort is not merely a technical concern but a spiritual one. The congregants who worshipped in comfortable light described enhanced spiritual engagement, deeper focus, and greater peace. Those who struggled against glare and uneven illumination described distraction, fatigue, and diminished worship. These testimonies suggest that architects designing sacred spaces bear a responsibility that transcends conventional professional obligations the responsibility to create environments where the human spirit can engage the divine without impediment.

5.2 Recommendations

For Architects and Designers: (1) Prioritize diffuse top-lighting over extensive vertical glazing; (2) implement permanent external shading on all fenestrations; (3) specify high-performance glazing (low-E, fritted); (4) adopt hybrid lighting approaches with photocell-controlled dimming; (5) select matte, light-colored interior finishes to avoid secondary glare.
For Religious Communities: (1) Engage architects early in discussions about light and worship; (2) resist cost-cutting that eliminates shading devices; (3) consider long-term operational costs of daylighting decisions.
For Policymakers: (1) Develop daylighting guidelines specific to Abuja's tropical climate; (2) incorporate daylight simulation into building approval processes; (3) incentivize passive design strategies.
For Future Research: Conduct longitudinal studies across seasons; expand scope to Catholic churches, mosques, and African Indigenous Churches; investigate the visual-thermal nexus with simultaneous measurements; conduct post-occupancy evaluations of churches designed using these guidelines.

5.3 Contribution to Knowledge

i. It provides the first comprehensive dataset linking specific daylighting strategies to measurable visual comfort metrics in Abuja's church buildings. The illuminance measurements, glare indices, and uniformity ratios documented here establish empirical baselines against which future designs can be evaluated.
ii. It demonstrates the critical importance of occupant perception as a performance metric. The strong correlation between quantitative measurements and qualitative satisfaction validates the methodological approach while underscoring that human experience, not merely technical compliance, must be the ultimate measure of design success.
iii. It offers a contextualized critique of design strategies imported from temperate climates. The dramatic failure of uncontrolled side-lighting in Abuja confirms that architectural solutions cannot travel unmodified across climatic boundaries a finding with implications far beyond ecclesiastical architecture.
iv. It articulates a framework for thinking about light in sacred spaces that moves beyond illumination to encompass visual comfort, thermal performance, and spiritual experience. This holistic perspective, grounded in both empirical data and human testimony, provides a foundation for more thoughtful design practice.

v. It amplifies the voices of ordinary worshippers whose experience of sacred space has rarely been systematically studied. Their testimonies of struggle and satisfaction, distraction and peace remind us that architecture ultimately serves people, not abstractions. In churches, where people gather to encounter the divine, this reminder carries weight.

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