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Performance Evaluation of Natural Lighting in University Student Residence in Nigeria

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ABSTRACT

Natural lighting in residential buildings, especially student hostels, plays a critical role in promoting energy efficiency, visual comfort, and environmental sustainability. This study evaluates the performance of daylighting in selected private hostels in Ile-Ife, Nigeria, through an integrated methodological framework combining objective lux measurements, subjective perception surveys, and ethnographic observations of bioclimatic design features. Indoor and outdoor illuminance were recorded during daylight hours using a calibrated light meter, and daylight factors were computed in reference to CIBSE LG10 guidelines. Questionnaire data from 200 respondents were analysed using ANOVA and t-tests to explore student behaviours and satisfaction with lighting conditions. Observations revealed the prevalence of passive design features such as courtyards, large windows, and shading devices. The findings reveal a prevalent condition of poor daylighting performance, with DF values typically ranging from 0.0008% to 2.05%, significantly below internationally recommended minimums for conducive living and study environments. Despite these objective shortcomings, subjective occupant satisfaction exhibited variability, with a notable portion expressing contentment. Many students (43.0%) utilize their hostel rooms as primary study locations, frequently necessitating artificial light supplementation. Observed passive design strategies included internal courtyards, screening elements, shading provisions, fenestration characteristics, balconies, circulation corridors, and pre-paid energy metering systems. The study concludes a substantial dependence on artificial lighting, driven by inadequate natural illumination design, and recommends targeted education and enforcement of building design regulations prioritizing daylight access to enhance energy conservation, visual comfort, and overall occupant well-being.

INTRODUCTION

The provision of adequate illumination is a fundamental requirement within contemporary built environments. It facilitates extending human activities beyond natural daylight hours and enhances safety and security within and around buildings (Altomonte, 2009; Konstantzos *et al.*, 2020). Artificial lighting technologies have undeniably changed architecture by offering precise control and adaptability to meet different occupant needs. These systems enable extended workdays, provide opportunities for study and leisure during nocturnal hours, and support specialized activities independent of external conditions (Altomonte *et al.*, 2020). However, this convenience comes at a significant environmental and economic cost. The over-reliance on artificial lighting constitutes a major component of building energy consumption, accounting for approximately 10% of total energy use in Nigerian buildings, a figure that can rise substantially higher in specific typologies like offices, potentially reaching 50% (Erifeta, 2025). This energy demand contributes directly to increased building cooling loads when inefficient lighting fixtures are employed and necessitates substantial electricity generation (Abdul Majid & Hussaini, 2011). The dominant modes of power generation through fossil fuels are linked to the emission of greenhouse gases like CO_2, which are implicated in global warming and broader environmental degradation and ozone layer depletion (Afifa *et al.*, 2024). Consequently, mitigating the dependency on artificial lighting has emerged as a critical global concern, driving efforts towards enhanced energy conservation and efficiency in the building sector (Firoozi *et al.*, 2025; Garba *et al.*, 2024; Hafez *et al.*, 2023).

Daylighting refers to the strategic use of sunlight to illuminate indoor spaces through architectural features such as windows, courtyards, skylights, and reflective surfaces (Ruck *et al.*, 2000). It is not merely an aesthetic concern but a scientifically grounded approach to improving visual performance, reducing energy costs, and supporting occupants' psychological and physiological well-being (Gentile *et al.*, 2022; Phillips & Gardner, 2012; Ruck *et al.*, 2000). Well-daylit buildings can cut lighting-related electricity consumption by 50–80%, depending on latitude, orientation, and architectural design (Aslam *et al.*, 2024). This reduction translates directly into lower operational costs for building owners and occupants and diminishes the environmental burden associated with power generation (Lee *et al.*, 2022). Beyond the tangible energy benefits, research consistently demonstrates that daylighting fosters healthier, more stimulating, and qualitatively superior luminous environments compared to purely artificial systems (Li & Lam, 2003). Exposure to natural light is correlated with enhanced occupant well-

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being, encompassing physiological benefits like improved vision and immune system function, psychological advantages such as improved mood and reduced stress, and, critically, increased productivity and performance in work and learning environments (Jimenez *et al.*, 2021; Negarestan, 2025). Several architectural and environmental factors must be carefully taken into account during the design phase in order for daylighting to be implemented successfully. Key elements include building form and its influence on light penetration depth (e.g., side-lighting limitations versus roof-lighting or atrium potential), building orientation relative to the sun's path to manage solar gain and optimize light availability, and meticulous window design, encompassing size, position (higher placement generally improving deeper penetration), glazing properties (transmittance, solar control coatings), and the integration of shading devices to mitigate glare and excessive heat gain (Lee *et al.*, 2022; Ruck *et al.*, 2000; Wong, 2017). The quality of the visual connection to the outside world, or 'view,' is another significant aspect influenced by window design, contributing to occupant satisfaction and psychological well-being (Achoba *et al.*, 2021).

Student hostels are a unique building typologies in which lighting quality is of particular importance. These facilities serve not only as residences but also as primary or secondary study environments for their occupants (Koranteng & Simons, 2012). Adequate lighting is therefore linked to student comfort, academic performance, and overall well-being (Chauca *et al.*, 2024). Despite these benefits, daylighting remains underutilized in Nigerian architecture, especially in low to mid-tier residential housing like private student hostels. The pressures of rapid urbanization, rising land costs, and the commodification of student accommodation have driven developers toward designs that prioritize room quantity over quality. Corridors are narrow, windows are undersized, and facades are poorly oriented, all of which severely compromise daylight ingress. Where passive design strategies do exist—such as courtyards or balconies—they are often implemented without scientific grounding or performance evaluation (Fadeyi *et al.*, 2024; Gwaivangmin, 2016). Gherri (2013), Hafez *et al.* (2023), and Reffat and Ahmad (2020) have shown the increasing awareness of daylighting in building design. They pointed out that proper daylight integration can substantially reduce lighting energy loads and enhance indoor environmental quality (Gherri, 2013; Hafez *et al.*, 2023; Reffat & Ahmad, 2020). Sinhai (2020) advocates for climate-responsive building orientation and window positioning as crucial determinants of solar access (Sinha, 2020). Furthermore, the physics of daylighting, as outlined by Grondzik and Kwok (2013), demonstrates that solar radiation, even when diffused through atmospheric scattering, can provide illuminance levels adequate for most indoor tasks—provided the building envelope is optimized (Grondzik & Kwok, 2019).

Other studies have rigorously assessed the actual performance of daylighting in student housing. Koranteng and Simons (2012), in a study of Ghanaian hostels, found that daylight factors often fall short of recommended thresholds due to poor spatial planning and glazing practices (Koranteng & Simons, 2012). Similar conclusions are drawn by Fadayi *et al.* (2024) and Gherri (2013), who highlight that passive architectural features like overhangs, shading devices, and internal courtyards significantly enhance daylighting efficiency and user comfort in institutional buildings (Fadeyi *et al.*, 2024; Gherri, 2013). Yet, these insights are rarely translated into policy or practice in private sector developments, leading to a persistent performance gap. While the advantages are well-documented globally, empirical data evaluating the actual implementation and effectiveness of daylighting strategies in this specific geographical and building-type context remains scarce. This lack of localized data hinders the development of evidence-based design guidelines and policy interventions aimed at improving energy efficiency and occupant comfort in this rapidly growing sector of the Nigerian building stock.

Therefore, this study seeks to address this identified knowledge gap by undertaking a performance evaluation of natural lighting in selected private student hostels located in Ile-Ife, Osun State, Nigeria. The overarching aim is to provide a quantitative and qualitative assessment of current daylighting conditions, thereby informing strategies to reduce dependency on artificial lighting and promote enhanced energy efficiency within these buildings. To achieve this aim, the research pursues three specific objectives: firstly, to examine the objective daylight performance of the selected hostels using established metrics such as the Daylight Factor; secondly, to investigate the subjective experiences and behaviours of student occupants concerning their use of both natural and artificial lighting, exploring their perceptions and satisfaction levels; and thirdly, to identify and critically assess the design parameters and bioclimatic strategies implemented within the studied hostels intended to enhance daylight performance. The findings generated from this investigation are intended to be significant for building professionals, including architects and engineers, as well as hostel developers and policymakers. This research intends to emphasise the significance of giving daylighting integration top priority in the design and retrofitting of student housing by offering empirical evidence on the current state of daylighting performance and highlighting both flaws and effective strategies. In the end, this will help to lower energy demand, improve visual environments, and improve the well-being of student occupants in Nigeria.

MATERIALS AND METHODS

This study adopted a mixed-methods approach involving objective measurements of illuminance, subjective assessments through questionnaires, and qualitative observations of bioclimatic architectural features. The triangulation of these methods enabled a holistic understanding of daylighting performance across nine private student hostels in Ile-Ife, Nigeria. The data collection phase spanned from December 2018 to February 2019, coinciding with the local harmattan period.

Study Area and Case Selection

A multi-stage sampling technique was adopted for selecting the study sites and participants. Initially, locations within Ile-Ife known for concentrating private student hostels due to their proximity to the university campus were identified through a reconnaissance survey, which catalogued 39 such facilities. For the objective measurement and detailed observation component, nine hostels were purposively selected from these locations, representing a sample fraction ranging from 21% to 100% of hostels within specific sub-areas. Selection criteria for these nine hostels included building orientation relative to the sun path, mode of construction (purpose-built versus converted), and gender occupancy (male, female, or mixed), ensuring a degree of representativeness. Within these selected hostels, individual rooms were chosen for detailed study based on their location within the building (e.g., different wings or floors) and, crucially, the willingness of occupants to grant access for measurements. For the subjective measurement component, aiming for a broader understanding of student perceptions and behaviours, questionnaires were distributed across a larger sample of 22 private hostels. A total of 200 questionnaires were administered, with respondents selected based on their availability and willingness to participate.

Objective Measurement of Illuminance and Daylight Factor

Objective data collection focused on quantifying indoor and outdoor illuminance levels. A calibrated digital Lux Meter (Light Meter) was utilized for these measurements. Readings were systematically taken between 12:00 PM and 4:30 PM daily, with measurements repeated at hourly intervals within the selected rooms to capture variations under different sky conditions and solar positions during peak daylight hours. All illuminance measurements were conducted at a consistent height of 0.8 meters above floor level, representing a typical seated working plane height for occupants. Indoor illuminance was measured at three distinct points within each studied room: near the window on the left, near the window on the right, and at the approximate centre of the room. The average of these three readings was subsequently used for analysis to represent the general illuminance level within the room. Simultaneous outdoor illuminance readings were taken hourly under unobstructed sky conditions, and the average outdoor value corresponding to the indoor measurement period was used for calculating the Daylight Factor. Strict adherence to operational procedures for the Lux Meter and precautions, such as ensuring instrument sensitivity and attempting measurements in rooms with varied window configurations where possible, were maintained to enhance data accuracy.

Subjective Measurement of Perception Survey

Subjective data were gathered using a structured questionnaire comprising 40 items. This instrument was designed to examine student usage patterns of natural and artificial light, their attitudes towards different lighting conditions, perceptions of adequacy and comfort, and overall satisfaction levels with the luminous environment and other related factors like thermal conditions, privacy, and view. The questionnaire was divided into five sections: respondent demographics (gender, age, religion); hostel information (occupancy per room, room type, hours spent in room); satisfaction levels assessed using a five-point Likert scale for various room features including natural lighting, ventilation, and window size, alongside questions on study habits and perceived health constraints in poor lighting; student perceptions regarding preferences between natural and artificial light, frequency of artificial light use, and opinions on daylight sufficiency and potential inconveniences like glare; and assessment of visual comfort aspects.

Field Observation and Bioclimatic Audit

Field observation employed ethnographic techniques, including structured observation checklists and walkthroughs of the nine selected hostels. This component aimed to identify and document the presence and characteristics of bioclimatic design strategies relevant to daylighting and natural ventilation. A 16-megapixel digital camera was used for photographic documentation, and a tape measure was used to record physical dimensions such as room sizes, corridor widths, and window dimensions. Observations focused on aspects like building form (courtyard vs. linear), orientation, opening characteristics (window-to-wall ratio, type, glazing), shading elements (balconies, overhangs, screen walls), courtyard features, landscaping presence, interior surface finishes, and any visible energy management systems.

Data analysis procedures were tailored to each data type. Objective illuminance data were primarily used to calculate the Daylight Factor (DF) for each measured point, defined as the ratio of internal illuminance (Ei) to external horizontal illuminance (Eo), expressed as a percentage (Ahmed *et al.*, 2011; Brembilla *et al.*, 2018):

$$DF(\%) = (E_i / E_0) \times 100$$

These calculated DF values were then benchmarked against the criteria outlined in the CIBSE Lighting Guide 10 (LG10-2004), which categorizes average DF levels as under 2% (inadequate), 2-5% (adequate with potential need for supplementary light), and over 5% (well-lit, potential glare issues) (Brembilla *et al.*, 2018). This comparison allowed for an objective assessment of daylight adequacy. Subjective data from the questionnaires were processed and analysed using the Statistical Package for Social Sciences (SPSS) software. Descriptive statistics, including frequencies and percentages, were generated to summarise occupant responses. Inferential statistical tests, specifically Analysis of Variance (ANOVA) and T-tests, were employed to explore potential significant differences in satisfaction levels or perceptions based on categorical variables, such as comparing responses between occupants of purpose-built versus converted hostels. ANOVA was chosen for its ability to compare means across multiple groups, while T-tests were used for comparing means between two groups. Finally, data gathered through field observations, including notes and photographic evidence, were subjected to content analysis. This involved systematically reviewing and codifying the observed bioclimatic design features and inferring their likely implications for natural daylighting performance within the hostels.

RESULTS AND DISCUSSION

The investigation yielded interesting results derived from the objective illuminance measurements, subjective questionnaire responses, and systematic field observations across the sampled private student hostels in Ile-Ife.

Objective Daylight Performance (Daylight Factor Analysis)

The core objective assessment centred on the calculation of the Daylight Factor (DF) based on indoor and outdoor illuminance measurements conducted in representative rooms across nine distinct hostels. The findings revealed a consistent pattern of generally inadequate daylighting performance, with DF values frequently falling significantly below established benchmarks for visual comfort and task performance, particularly the 2% threshold often cited by CIBSE for adequate daylighting in living and study spaces. Table 1 shows the primary data source for the objective assessment and directly presents the calculated indoor illuminance, outdoor illuminance, and Daylight Factor for each studied room in each hostel.

Table 1: Summary of the performance of daylight in the studied hostel and rooms

Hostels	Room	Indoor Illuminace (LUX)	Outdoor Illuminace (LUX)	Daylight factor (DF)
Finetouch	RM 58	9.68	51,000	0.02
	RM 67	0.17		0.0034
Rock of	A12	1.89	47,000	0.002
Ages	B4	11.24		0.022
	C1	7.5		0.012
Adejare	6C	5.82	500,000	0.012
	9A	5.4		0.011
	8B	11.5		0.22
Olateen	RM 8	160	50,000	0.32
AP	RM A	778	48,000	1.62
	RM B	986		2.05
Varsity	A18	108	50,000	0.22
	B15	72.5		0.15
BVER	A12	64.85	50,000	0.13
	B38	77.81		0.3
Peace	RM 6	160	49,000	0.32
	RM 12	180		0.36
De-Gold	A9	31.8	50,000	0.064
	D1	0.38		0.0008

Source: field survey. Number of respondents: 200

Fine-touch Hostel exhibited DF values ranging from a negligible 0.0034% to 0.06% in the measured rooms, indicating extremely poor daylight penetration despite substantial available outdoor light (mean outdoor illuminance recorded at 51,000 lux). Rock of Ages Hostel similarly demonstrated low performance, with DF values between 0.002% and 0.022%. Contributing factors observed included low window-to-wall ratios (calculated at 10%) and potential obstructions from fenced balconies. Adejare Hostel presented DF values of 0.011% to 0.022%. A low window-to-wall ratio (12%), the presence of only single windows per room, and the use of dark interior paint colours (predominantly purple) were identified as likely contributing factors. Notably, a room painted with a lighter colour (yellow) and oriented towards a light shelf showed slightly better, though still inadequate, performance. Olateen Hostel, despite having a window-to-wall ratio of 20% which is often considered a reasonable minimum, yielded a DF of only 0.32% in the studied room. Its east-facing orientation was noted as a potential source of direct sunlight and glare issues rather than consistent diffuse daylight.

In stark contrast, AP Hostel demonstrated considerably better performance relative to the others, achieving DF values of 1.62% and 2.05%. This superior performance, approaching the CIBSE ‘adequately lit’ category, was attributed to a combination of positive design features: a higher window-to-wall ratio (22.85%), the incorporation of light shelves to redirect daylight deeper into the space, the use of light-coloured interior paint enhancing internal reflectance, and a more favourable north-south building orientation potentially mitigating excessive solar gain and glare. Varsity Hostel, despite a 20% window-to-wall ratio, recorded low DF values of 0.22% and 0.15%. Obstructions such as a nearby fence and the use of pink interior paint were identified as detrimental factors. BVER Hostel showed DF values of 0.13% and 0.30%, linked to a window-to-wall ratio below the recommended minimum (16%), the potentially insufficient size of its internal courtyard for effective light distribution, and observed occupant use of curtains. Peace Hostel yielded DFs of 0.32% and 0.36%, with performance likely hindered by external obstructions (a fence close to windows) and a slightly low window-to-wall ratio (17%). De Gold Hostel exhibited exceptionally poor performance, with recorded DF values as low as 0.064% and an almost negligible 0.0008%. This was attributed to a confluence of negative factors, including unfavourable orientation, limited window access to daylight, significant obstructions, the use of dark interior paint (purple), and a very low window-to-wall ratio (10%).

Summarizing the objective findings, only one hostel (AP) approached the lower threshold for adequate daylighting based on the DF metric. The vast majority demonstrated illuminance levels significantly below recommended minimums, classifying them as ‘not adequately lit’ according to CIBSE guidelines. The consistently high outdoor illuminance levels measured during the study periods strongly suggest that the poor indoor performance is primarily a result of ineffective building design and execution rather than a lack of available ambient daylight.

Subjective Occupant Perceptions and Lighting Usage

Analysis of the 200 completed questionnaires provided insights into the students’ subjective experiences and behaviours related to lighting. The result shows that the respondent pool consisted primarily of females (64.5%) and individuals aged 20-25 years (60.5%). A significant portion of students reported spending considerable time in their hostel rooms, with 52% indicating they spend more than 6 hours per day there. Importantly, 43% identified their hostel room as their primary study location, compared to 17% who primarily use the school library and 40% using other locations like friends’ rooms. Study times were predominantly preferred during the morning (53%) or night (45%) as shown in the pie chart below.

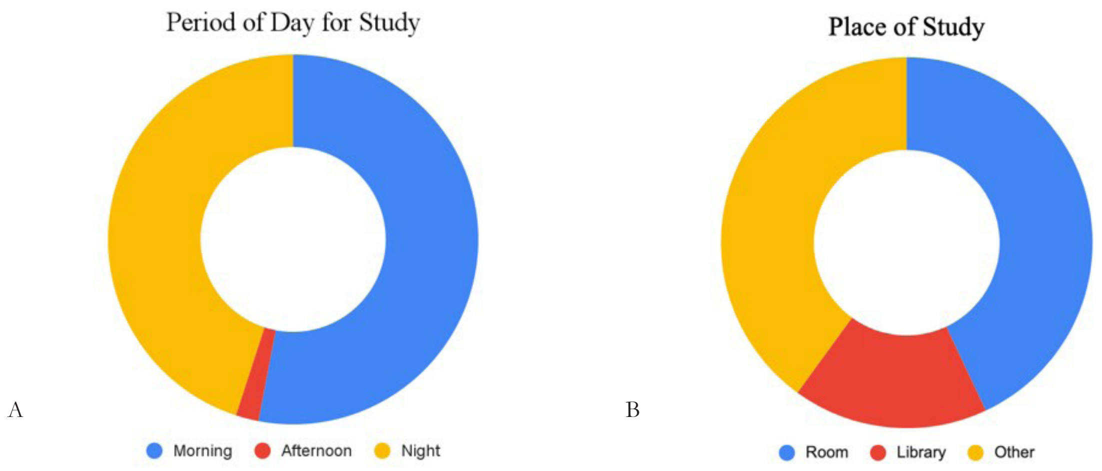

Figure 1: Respondents Study Habits
Source: field survey, 2019. Number of respondents: 200

Regarding satisfaction with lighting, the subjective responses presented a degree of contradiction to the objective measurements. A notable 39% of respondents reported being ‘very satisfied’ with the natural lighting in their rooms, and overall satisfaction levels were mixed. When asked about overall room lighting (combining natural and artificial), 47.5% rated it as ‘sufficient’ and 38% as ‘absolutely sufficient’. Furthermore, 62% of respondents felt that natural light alone was enough for carrying out daytime activities, including reading. However, this perception was counterbalanced by other responses: 59% stated a preference for working with a combination of natural and artificial light, and a significant proportion reported frequent use of artificial lighting, with 44.5% indicating they ‘always’ use it and 22% ‘often’ use it. This frequent recourse to artificial lighting aligns more closely with the objective findings of inadequate daylight levels.

In terms of visual comfort, 60.5% rated the natural light level as ‘comfortably bright’. Glare from daylight did not appear to be a widespread major issue, with 42% reporting they ‘never’ experienced disturbing glare; for those who did, direct sun was the main source (34%). When asked about health constraints experienced when working in poorly lit conditions (attributed to poor weather in the question framing), eyestrain (33%) and fatigue (28%) were the most commonly reported issues, followed by dizziness (21.5%). Windows were overwhelmingly considered important (96%), primarily valued for allowing fresh air entry (65.5%) and providing a view, rather than solely for illumination. The most cited disadvantage of windows was reduced privacy (20%), followed by concerns about heat gain or drafts. A statistically significant difference (p=0.086 at 10% significance level via ANOVA; confirmed by T-test at 5% significance) was found in satisfaction levels between occupants of purpose-built private hostels and those residing in buildings converted into hostels, suggesting potential variations in design quality or occupant expectations between these sub-types. Table 2 shows a snapshot of the respondents' living and room characteristics.

Table 2: Some living and room characteristics

Characteristic	Distribution (Frequency %)
Hostel Type	
Boys only	4 (2.0%)
Girls only	69 (34.5%)
Boys and girls	127 (63.5%)
Average Hours Spent in Room	
Less than 2 hours	2 (1.0%)
2-4 hours	7 (3.5%)
4-6 hours	87 (43.5%)
More than 6 hours	104 (52.0%)
Number of Windows	
One	86 (43.0%)
Two	100 (50.0%)
More than two	14 (7.0%)
Window Position (if Two)	
Directly opposite each other	97 (48.5%)
Alternate position	14 (7.0%)
Not Filled	89 (44.5%)

Source: field survey. Number of respondents: 200

Observed Bioclimatic Design Strategies

Field observations conducted across the nine hostels selected for detailed study documented the presence and characteristics of various bioclimatic design features potentially influencing daylighting performance. Seven of the nine hostels employed a courtyard building layout, while two utilized a linear arrangement. Courtyard forms inherently offer potential for improved daylight distribution to rooms facing the internal space and adjoining balconies, although the effectiveness depends heavily on the courtyard's dimensions and proportions relative to building height. Building orientation varied: several hostels exhibited an East-West alignment, which can increase solar heat gain challenges, while others adopted a North-South orientation, generally considered more favourable for managing solar exposure in the region. Window placement often did not appear optimized with respect to prevailing wind directions (typically southwest) for facilitating natural cross-ventilation.

Regarding openings, window-to-wall ratios were frequently observed to be below the commonly recommended minimum of 20% for adequate daylighting. Most hostels utilized sliding windows, often fitted with tinted glass; specific glare control measures beyond occupant-installed curtains were generally absent. Only AP hostel was observed to incorporate light shelves as a specific daylight-enhancing feature. Balconies or verandahs were a common feature, present in all nine observed hostels, potentially offering some shading and transitional space. Internal courtyards existed in the seven hostels with that layout type. Explicit overhangs designed for solar shading were generally lacking. Some hostels incorporated decorative screen walls on balconies, which might offer partial shading but could also obstruct light. Landscaping features were minimal, with only three hostels having designated green areas; pitched roofs precluded rooftop garden possibilities. Interior paint colours varied widely, with observations of dark colours like purple and pink in several hostels, which possess low reflectance values and hinder internal light distribution. Energy-saving bulbs (like CFLs or LEDs) were commonly observed. A notable energy management strategy was the use of individual pre-paid electricity meters for each room in Fine-touch hostel, a measure reported by occupants and the researcher to encourage more conscious energy use compared to systems where electricity costs are included in the rent or billed collectively. Other hostels employed less direct metering approaches. Table 3 systematically lists the observed physical and design characteristics of each studied hostel, directly supporting the discussion of building form, orientation, window types, shading devices, courtyards, and landscaping in relation to bioclimatic principles and their potential impact on daylighting.

Table 3: The characteristic and bioclimatic design strategies demonstrated at the studied hostels

Internal Systems	Characteristic	Adejare Hostel	Bver Hostel	Fine Touch Hostel	AP Hostel	Olateen Hostel	Peace Hostel	Varsity Hostel	De Gold Hostel	Rock of Ages Hostel
	Form of building	Low rise	Low rise	Low rise	Low rise	Low rise	Low rise	Low rise	Low rise	Low rise

Residential Unit -Form Configuration & Planning Enclosure and Façade Design						Built-Form Configuration, Orientation, Site Layout Planning & Energy Index				
Window to wall ratio	Window area (m^2)	Design	Typical room volume (m^3)	Typical room's floor area (m^2)	Typical room dimension (l) x (w) x	Floor level (excluding GF)	Building location on the ground	Wind direction of the locality	Orientation to sun path	Building layout
12%	0.81	Glare protection & adjustable natural ventilation option	25.92	8.64	3.6 x 2.4 x 3.0	1	Same altitude	SW	W-E	Courtyard arrangement
		Glare protection & adjustable natural ventilation option	39.99	13.33	4.3 x 3.1 x 3.0	1	Same altitude	SW	N-S	Courtyard arrangement
15%	1.8	Glare protection & adjustable natural ventilation option	36	12	4.0 x 3.0 x 3.0	1	Same altitude	SW	W-E	Courtyard arrangement
		Glare protection & adjustable natural ventilation option	30.24	10.08	3.6 x 2.8 x 3.0	1	Same altitude	SW	W-E	Courtyard arrangement
20%	1.8	Glare protection & adjustable natural ventilation option	32.4	10.8	3.6 x 3.0 x 3.0	1	Same altitude	SW	W-E	Linear arrangement
		Glare protection & adjustable natural ventilation option	28.8	9.6	3.2 x 3.2 x 3.0	0	Same altitude	SW	N-S	Linear arrangement
20%	1.8	Glare protection & adjustable natural ventilation option	40.5	13.5	4.5 x 3.0 x 3.0	1	Same altitude	SW	N-S	Courtyard arrangement
10%	0.81	Glare protection & adjustable natural ventilation option	38.88	12.96	3.6 x 3.6 x 3.0	1	Same altitude	SW	N-S	Courtyard arrangement
8.5%	0.56	Glare protection & adjustable natural ventilation option	56.7	18.9	3.0 x 6.3 x 3.0	1	Same altitude	SW	N-S	Linear arrangement

Passive Daylight Concepts Landscaping				Solar Control Devices						
Green area	Potential for rooftop garden	Balconies/ Verandah	Articulated light shelves	Skycourts/ Internal courtyard	Balconies/ Verandah	Tinted window glass	Vertical overhangs along the wall with windows	Horizontal overhangs along the wall with widow	Location	Window design
×	×	√	√	√	√	×	×	×	N-S	Casement window
×	×	√	×	√	√	√	×	×		Sliding window with shading device
√	×	√	√	√	√	×	×	×	W-E	Casement window with shading device
×	×	√	×	√	√	√	×	×		Sliding window with shading device
×	×	√	×	×	√	√	×	×	W-E	Sliding window with shading device
×	×	√	×	×	√	√	×	×		Sliding window with shading device
×	×	√	×	√	√	√	×	×	N-S	Sliding window with shading device
√	×	√	×	√	√	√	×	×	W-E	Sliding window with shading device
√	×	√	×	×	√	√	×	×	N-S	Sliding window with shading device

Source: Author's own eleboration

The comprehensive analysis of objective measurements, subjective occupant feedback, and observed design characteristics within private student hostels in Ile-Ife reveals a complex picture characterized by a significant disconnect between quantifiable daylighting performance and perceived occupant satisfaction, ultimately pointing towards suboptimal design practices and a substantial reliance on artificial illumination. The objective data, primarily derived from Daylight Factor (DF) calculations, consistently indicated poor performance across the majority of the studied facilities. With DF values predominantly falling below the CIBSE recommended minimum of 2% for adequate daylighting in living and study environments, it is evident that most hostel rooms do not receive sufficient natural light for occupants to comfortably perform visual tasks without supplementation. The stark contrast provided by AP hostel, which approached the adequacy threshold, serves to highlight the critical role of deliberate design choices. Its superior performance was linked to tangible factors such as a higher window-to-wall ratio, the strategic use of light shelves, favourable orientation, and light-coloured interior surfaces, demonstrating that achieving better daylighting is feasible within the local context through informed design. The widespread inadequacy in other hostels, despite abundant ambient daylight availability as evidenced by high outdoor illuminance readings, strongly implicates shortcomings in architectural design and implementation as the principal cause. Specific recurrent deficiencies included insufficient glazed areas (low window-to-wall ratios), orientations leading to either excessive glare or insufficient light penetration, the presence of external obstructions like fences or adjacent structures, the common use of low-reflectance interior finishes (dark paints) that absorb light rather than distribute it, and the often ineffective implementation of potentially beneficial passive strategies like undersized courtyards.

Intriguingly, the subjective responses from student occupants painted a more favourable picture, with a significant portion expressing satisfaction with natural lighting levels and believing daylight alone was sufficient for daytime activities. This apparent contradiction between objective deficiency and subjective contentment warrants careful consideration. It could be attributed to several factors, including occupant adaptation to suboptimal conditions (normalisation of low light levels), potentially lower expectations shaped by prevailing building standards or prior experiences, or a prioritisation of other window-related benefits such as ventilation or view over illuminance levels. The positive psychological association with having any window access, regardless of its quantitative performance, might also play a role. However, this expressed satisfaction is challenged by the concurrent findings that a majority preferred using a combination of natural and artificial light, and nearly half reported always using artificial lighting. This behavioural data strongly suggests that occupants are, in practice, compensating for the inadequate natural light levels identified by the objective measurements, thereby validating the DF findings indirectly through observed behaviour. The reporting of eyestrain, fatigue, and dizziness as health constraints associated with poor lighting conditions further reinforces the negative implications of the measured deficiencies.

The study underscores the critical importance of integrating bioclimatic and passive design principles from the very inception of building projects, particularly for residential typologies like student hostels where occupants spend significant time. Features such as well-proportioned courtyards, appropriately sized and strategically placed windows, effective shading strategies (like overhangs or properly designed balconies), and the use of high-reflectance interior materials are demonstrably crucial for maximizing daylight penetration and distribution while managing potential downsides like glare and heat gain. The observations revealed that while elements like courtyards and balconies were common, their mere presence did not guarantee effectiveness; poor execution, such as inadequate courtyard dimensions relative to building height or insufficient window sizing, severely limited their potential benefits. Furthermore, the study highlighted the potential impact of energy management strategies on occupant behaviour. The implementation of individual pre-paid electricity meters in one hostel appeared to foster greater energy consciousness among students, directly tackling the ‘split incentive’ problem often seen in rental situations where occupants do not directly bear the cost of their energy consumption and may thus exhibit more wasteful behaviour. This suggests that combining passive design improvements with behavioural interventions through appropriate metering and billing structures could yield synergistic benefits for energy conservation. The significant difference in satisfaction found between purpose-built and converted hostels also points towards the potential pitfalls of adapting existing buildings without sufficient consideration for environmental performance criteria like daylighting, often resulting in compromised living conditions.

CONCLUSION

The evaluation conducted across private student hostels in Ile-Ife, Nigeria, concludes that the prevailing performance of natural lighting is predominantly inadequate when assessed against established objective standards for visual comfort and energy-efficient design. Measured Daylight Factors consistently fell below recommended minimums in the majority of spaces studied, indicating insufficient natural illumination for typical daytime activities, including study. This objective deficiency necessitates substantial reliance on artificial lighting systems throughout the day, directly contributing to increased energy consumption and negating the potential environmental and economic benefits of daylight harvesting.

While subjective occupant satisfaction levels presented a degree of variability and sometimes contradicted the objective findings, reported behaviours, particularly the frequent and often constant use of artificial lighting alongside a preference for combined lighting sources, implicitly corroborate the measured inadequacy of natural light. The identified shortcomings in daylighting performance are primarily attributable to deficiencies in architectural design and implementation. Key recurring issues include insufficient window-to-wall ratios, suboptimal building orientation leading to poor light quality or glare, the presence of external obstructions, the use of interior finishes with low reflectance values, and the ineffective application or absence of crucial bioclimatic design strategies such as appropriately sized courtyards, light shelves, and effective solar shading. Although passive elements like balconies and courtyards were commonly observed, their design often lacked the refinement needed to maximize their daylighting potential. The study highlights a critical need for improved design practices that prioritize natural light integration to enhance the quality and sustainability of student housing in this context.

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