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Investigating the Impact of Indoor Environmental Disparities' Influence on Youth Comfort and Well-Being in Abuja's Community and Educational Facilities

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Abstract

This study investigates disparities in Indoor Environmental Quality (IEQ) and their impact on user comfort in youth spaces in Abuja, Nigeria. Adopting a mixed-methods approach, we combined quantitative surveys (286 valid responses) with qualitative case study observations to evaluate thermal comfort, air quality, lighting, acoustics, and spatial adaptability. Data analysis using IBM SPSS (descriptive statistics, Chi-square tests, Pearson correlations) revealed significant user dissatisfaction with air quality (42.3%) and thermal comfort (32.9%), driven by poor ventilation, rigid layouts, and over-reliance on mechanical cooling. A Chi-square test confirmed a statistically significant association between comfort levels and visit frequency (χ^2 = 25.19, p = .014), highlighting how environmental discomfort discourages sustained engagement. Case studies of youth centers in Abuja and Lagos, Nigeria, underscored systemic design flaws, including sealed windows, inadequate daylighting, and fixed seating, contradicting user demands for adaptive, climate-responsive spaces. The findings align with global IEQ standards (e.g., ASHRAE) and emphasize the urgency of retrofitting existing facilities with passive strategies. We propose actionable interventions, operable windows, cross ventilation, modular furniture, and solar-powered systems to enhance comfort, flexibility, and energy resilience. By prioritizing participatory design frameworks and user-centered evaluations, this study offers a roadmap for creating inclusive, sustainable youth spaces in Sub-Saharan Africa, urging policymakers and architects to adopt IEQ-sensitive guidelines in rapidly urbanizing regions.

Keywords: Indoor Environmental Quality (IEQ), User Comfort, Youth Spaces, Climate-Responsive Architecture, Sub-Saharan Africa.

Introduction

Recent architectural and urban discourse has increasingly emphasized the role of Indoor Environmental Quality (IEQ) in shaping comfort, health, and productivity within built spaces. This is particularly critical in youth and activity centers, where environmental conditions directly influence engagement, learning, and emotional well-being. IEQ encompassing thermal comfort, air quality, lighting, and acoustics is central to how users experience buildings (Abdulaali et al., 2025). The significance of these factors is heightened in youth spaces, which are expected to foster learning and recreation, emotional support, and personal development. Abuja, Nigeria's capital (9.07°N, 7.48°E), experiences a tropical wet-and-dry climate with high temperatures and seasonal humidity fluctuations. At 840m above sea level, its elevation moderately alleviates heat stress but does not eliminate thermal discomfort, particularly in poorly ventilated or densely occupied buildings (Ileanwa Abdul et al., 2024). Rapid urbanization, especially in the Abuja Municipal Area Council (AMAC), has led to inconsistent IEQ standards in public youth centers. Many suffer from overheating, inadequate ventilation, poor acoustics, and lighting deficiencies, conditions that undermine user comfort and program effectiveness. These issues echo findings in Nigerian office environments, where poor layouts and thermal discomfort have been linked to reduced productivity and psychological stress (Ogunleye et al., 2025), pointing to systemic shortcomings in the design and maintenance of indoor environments.

Globally, IEQ research has largely focused on institutional buildings in temperate climates, especially in North America, Europe, and East Asia, where high-performance building standards and post-occupancy evaluation practices are more common (Ackley & Ukpong, 2019). In contrast, youth-oriented buildings in tropical, under-resourced urban contexts remain under-studied, particularly in West Africa. Studies that do exist tend to generalize IEQ requirements without accounting for local climate, cultural activity patterns, or youth-specific engagement needs. This lack of context-sensitive evidence creates a critical gap in IEQ knowledge and design practice in sub-Saharan Africa.

This study addresses that gap by evaluating the environmental performance of youth and activity centers in Abuja, Nigeria. It contributes a user-centered, climate-responsive perspective that foregrounds comfort disparities among diverse user groups and proposes adaptive design strategies tailored to local realities. By

emphasizing participatory feedback and cultural specificity, this research extends current IEQ discourse beyond global North-centric models and offers grounded insights for improving youth spaces in comparable tropical urban contexts.

Objectives

i. Evaluate the impact of IEQ factors (thermal comfort, ventilation, lighting, and acoustics) on user comfort in Abuja's youth centers.
ii. To analyze how users' demographics and activity types influence their perceived comfort.
iii. To identify user-proposed design interventions to optimize IEQ in these spaces.

LITERATURE REVIEW

Conceptual Review

The indoor environment of a building affects the health, comfort, and performance of its inhabitants. Effective design outcomes require a combination of the four interrelated components of IEQ: thermal comfort, air quality, lighting, and acoustic considerations. The focus on thermal comfort is often on hot climates like Abuja, where high ambient temperatures and humidity, along with little passive cooling, pose significant challenges (Mustapha et al, 2023). Elevated CO2 levels, particulate matter (PM2.5/PM10), and volatile organic compounds (VOCs) in Nigerian public buildings correlate with respiratory discomfort and reduced user satisfaction (Agmada & Ismaila, 2025).

Daylighting critically influences circadian rhythms and visual comfort, whereas poor lighting contributes to eye strain and increased reliance on artificial sources. A lack of access to natural light can result in discomfort, eye strain, and a greater dependence on artificial lighting. Optimal daylighting design leads to energy conservation and enhanced feelings of contentment. Despite being overlooked, acoustics have a surprisingly strong influence on user experience.' Excessive noise or poor sound control can also reduce space usability, especially in multifunctional environments. According to Sallese (2024), IEQ should be regarded as a holistic concept, as suggested by recent perspectives. In resource-limited environments where mechanical systems are not reliable, post-occupancy evaluations are recommended as a means of understanding the user experience of buildings. Comfort extends beyond thermal conditions to encompass physical well-being and psychological belonging, a key consideration in youth-centric spaces (Samson, 2024). In youth centers, the presence of these attributes is especially significant because users are often diverse, and activities can be multifunctional (Sharpe et al., 2019). Insufficient ventilation, lighting conditions, and cold temperatures are believed to inhibit youth participation and decrease their usage frequency, as stated by Samson.

A place designed for learning requires a different set of environmental elements, making comfort dependent on the environment in which it is situated. The advocacy of user-centered evaluation tools by Sallese (2024) aims to promote inclusive and responsive

design by collecting feedback from diverse groups. Spaces that serve different purposes across time and user groups require flexibility and adaptability.

Theoretical Review

This research is based on the theories of User-Centered Design (UCD) and Climate-Responsive Design. User-Centered Design (UCD) prioritizes occupants' needs through iterative feedback, ensuring spaces align with actual usage patterns rather than assumptions. Effective designs, as argued by Sallese (2024) and others, consider user preferences from the moment they are created to the time they remain after occupancy. The approach guarantees that buildings serve genuine requirements, not suppositions made to certain groups, such as the youth. Climate-Responsive Architecture aims to achieve comfort through passive adaptation, considering local environmental conditions. By leveraging site-specific factors, solar orientation, prevailing winds, and thermal mass, climate-responsive design minimizes reliance on mechanical systems (Ogundiran, 2023). It is a principle found in techniques including passive ventilation, daylighting, thermal massing, and spatial zoning. By introducing flexibility and user control, adaptive design supplements the benefits of climate responsiveness. The. Its features include operable windows, movable partitions, modular furniture, and integrated solar energy to improve comfort and long-term usage.

Empirical Review

Multiple studies in Sub-Saharan Africa have reported instances of environmental performance problems in public and educational facilities, particularly in hot-humid areas. Secondary schools frequently experience heat stress and poor air quality, as evidenced by Shukla et al. (2024), who found that inadequate ventilation and outdated construction methods contributed to these issues. Similarly, Agmada and Ismaila (2025) observed that many public buildings in Nigeria lacked proper ventilation systems and had inadequate pollutant control. These findings align with Ogunleye et al. (2025), who quantified workspace discomfort in Nigerian offices, attributing 65% of occupant dissatisfaction to poor spatial layouts and inadequate passive cooling strategies. Such studies collectively highlight a pressing need for climate-responsive retrofits across Nigeria's public and institutional buildings.

A study carried out by Justice et al. (2024) demonstrates that passive strategies (e.g., cross-ventilation, thermal zoning) improve thermal comfort while reducing energy demand. Adaji (2016) and others have conducted research on the use of traditional climate-responsive design strategies in schools and community centers across tropical Africa, with similar findings being observed. According to case studies by Malhotra and Dobriyal (2023), older community buildings were retrofitted with passive systems like shading devices, improved daylighting, or stack ventilation, resulting in significant gains in comfort without increased operational costs. The performance gap, discrepancies between

predicted and actual building performance, underscore the need for post-occupancy evaluations. The significance of this lies in the changing usage patterns and varied comfort needs in spaces that are intended for young people.

METHODOLOGY

This study adopted a mixed-methods approach, combining quantitative data from structured questionnaires with qualitative insights from site observations. The aim was to evaluate Indoor Environmental Quality (IEQ) and user comfort in selected youth and activity spaces in Abuja. A structured questionnaire was developed to capture users' perceptions of thermal comfort, air quality, lighting, acoustics, spatial flexibility, and energy use. Participants were defined as youths aged 18–30, aligning with the United Nations' demographic categorization (18–24) and Nigeria's National Youth Policy (18–30) to account for local and global benchmarks. Spaces were selected based on (i) location in urban Abuja, (ii) functional typology (youth-focused), (iii) high youth footfall, and (iv) relevance to public or community-centered programming.

The sample size was determined using Cochran's formula for infinite populations. A total of 384 questionnaires were distributed using purposive sampling, targeting active users of youth centers and activity hubs. Of these, 286 were completed and returned, yielding a response rate of 74.5%, which is considered robust for research in the built environment.

Data was analyzed using SPSS through descriptive statistics and cross-tabulations to uncover patterns and correlations across key comfort variables. Collected data were analyzed to assess user satisfaction and perceived challenges with key IEQ parameters:

i. Thermal Comfort (temperature perception and ventilation)
ii. Air Quality (freshness, stuffiness, and pollutant perception)
iii. Lighting (natural vs. artificial lighting adequacy)
iv. Acoustics (noise levels and disruption)
v. Spatial Comfort & Flexibility (seating, multipurpose adaptability)
vi. Energy Use (presence of renewables, power outage frequency)

While this study provides insights into IEQ disparities in formal urban youth centers, its exclusion of rural and informal youth spaces, common gathering points for young people in Abuja's peri-urban areas, limits the applicability of findings to non-urban or unstructured environments.

Case Study Integration

On-site assessments of the two case studies complemented the quantitative findings. Although both centers were in varying states of renovation or inactivity, their design layouts, IEQ features, and usage patterns were observed and documented. These observations were used to validate or contrast survey responses. Case studies were selected based on typological relevance, geographical spread (North and South),

institutional affiliation (public ownership), and accessibility during the data collection window.

a. Onikan Youth Centre, Lagos: Currently under renovation; direct interaction with the site engineer helped gather background and operational insights.



Plate 1: Ongoing renovation works at Onikan Youth Centre, Lagos, as observed during the field visit
Source: Author's fieldwork

b. FCT Youth Support Centre, Nyanya, Abuja: Though not fully operational during the visit, the multipurpose hall was observed to be used for external activities. Access to the building allowed for observation of spatial conditions and facilities.



Plate 2: Live photograph of FCT Youth Support Centre, Nyanya, Abuja
Source: Author's fieldwork

The partial operation of the FCT Centre limited observations of live user interactions, but spatial assessments still provided critical insights into IEQ shortcomings. While Abuja remains the primary focus, the Onikan Youth Centre (Lagos) provides comparative insights into systemic IEQ challenges across Nigerian urban youth spaces. Its renovation efforts reflect common design pitfalls, such as prioritizing aesthetics over passive cooling, observed in Abuja's FCT Centre. Access to fully operational centers was limited due to ongoing renovations, which restricted deeper real-time analysis of live user engagement. Nevertheless, feedback from active users and physical walkthroughs provided valuable insights.

Ethical Considerations

Ethical approval for the study was obtained from the relevant faculty ethics CULREC (Caleb University, Lagos Ethical Clearance Committee) board at Caleb University. Participants were informed of the study's purpose and their rights through an introductory script attached to the questionnaire. Participation was voluntary, anonymous, and respondents could withdraw at any time. For the youth demographic (18–30), no minors were included; all respondents were legally adults, thus eliminating the need for parental consent. Nevertheless, care was taken to ensure data confidentiality and cultural sensitivity.

RESULTS AND DISCUSSION

Analysis of Demographics

TABLE 1

Frequency table of Gender, Age, and Highest educational qualification of respondents

Factor	**N (Number of respondents)**	**%**
Gender of Respondents		
Male	158	55.2%
Female	128	44.8%
Age of Respondents		
18-22	100	35.0%
23-26	90	31.5%
27-30	96	33.6%
Highest Educational Qualification		
SSCE	66	23.1%
BSc/First Degree (in progress)	109	38.1%
Graduate	111	38.8%
Total	286	100%

Source: Author (2025).

The study sample of 286 respondents included 55.2% males and 44.8% females, reflecting a fairly balanced gender distribution. Most respondents were aged 18–30, aligning with the target demographic for youth centers. Educationally, 76.9% were either pursuing or had completed tertiary education, indicating a user group capable of providing informed feedback on comfort and environmental conditions in public spaces.

Analysis for Objective 1

Objective 1: Evaluate the impact of IEQ factors (thermal comfort, ventilation, lighting, and acoustics) on user comfort in Abuja's youth

TABLE 2

Frequency table of Satisfaction: Indoor Air Quality, Noise levels, Lighting conditions, and Thermal comfort

Factor	**N (Number of respondents)**	**%**
Satisfaction: Indoor Air Quality		
Very Satisfied	80	28.0%
Neutral	85	29.7%
Not Satisfied	121	42.3%
Noise Levels		
Very Satisfied	74	25.9%
Neutral	114	39.9%
Not Satisfied	98	34.3%
Satisfaction: Lighting Conditions		
Very Satisfied	73	25.5%
Neutral	125	43.7%
Not Satisfied	88	30.8%
Satisfaction: Thermal Comfort		
Very Satisfied	76	26.6%
Neutral	116	40.6%
Not Satisfied	94	32.9%
Total	286	100%

Source: Field Survey Data analyzed in IBM SPSS (2025)

Table 2 presents user satisfaction levels across four key indoor environmental quality (IEQ) parameters: air quality, noise, lighting, and thermal comfort. Dissatisfaction dominated all IEQ parameters, with air quality (42.3%) and thermal comfort (32.9%) ranking lowest (Table II). Observational data from the FCT Youth Support Centre in Abuja revealed sealed windows and reliance on air conditioning, a strategy ill-suited to frequent power outages. These findings mirror Mustapha et al. (2023), who attributed similar trends in Nigerian public buildings to inadequate passive design. For instance, only

28% of users reported satisfaction with ventilation, a critical flaw in Abuja's humid climate, where cross-ventilation and solar shading are essential yet often absent. Also, Adamu et al. (2023) confirmed that discomfort from heat and poor air quality significantly impacts user well-being and productivity in youth spaces. Architecturally, this underscores a lack of passive design strategies, such as cross ventilation, effective orientation, thermal mass, and shaded fenestrations, highlighting the urgent need for climate-responsive retrofitting in youth spaces. These results form the foundation for proposing operable windows, courtyards, and thermally adaptive envelopes as key interventions.

Analysis for Objective 2

Objective 2: To analyze how users' demographics and activity types influence their perceived comfort.

TABLE 3

Frequency of Type of Youth Space Visited

	N (Number of respondents)	**%**
An officially designated youth center	28	9.8%
A community space providing youth activities, but not officially called a youth center	34	11.9%
A recreational facility (e.g., sports complex, youth club)	79	27.6%
A vocational/skill training center	97	33.9%
An office/workspace	48	16.8%
Total	286	100%

Source: Field Survey Data analyzed in IBM SPSS (2025)

According to the results in Table 3, the most frequented youth spaces are vocational/skill centers (33.9%) and recreational facilities (27.6%), while formally designated youth centers recorded the lowest patronage (9.8%). The data in Table 4 shows that dominant activities include work tasks, skill training, and social events, each involving more than 38% of respondents.

TABLE 4
Frequency of Activities Done in Spaces

		Responses		Percent of Cases
		N	Percent	
Activities done in Space	Work-related tasks	112	21.1%	39.9%
	Educational programs (workshops, training, etc.)	101	19.0%	35.9%
	Recreation facility	97	18.3%	34.5%
	Skill-building & vocational training center	109	20.5%	38.8%
	Social events & Networking	112	21.1%	39.9%
Total		531	100.0%	189.0%
a. Dichotomy group tabulated at value 1.				

Source: Field Survey Data analyzed in IBM SPSS (2025).

Respondents engaged in a variety of activities, with the most common being work-related tasks and social events (both 39.9%). This was closely followed by skill-building (38.8%), educational programs (35.9%), and recreation (34.5%), showing that youth spaces support diverse functions, especially work, learning, and social interaction.

TABLE 5
Frequency Table of Overall Comfort Level of the Space

	N (Number of respondents)	**%**
Very comfortable	69	24.1%
Somewhat comfortable	67	23.4%
Neutral	75	26.2%
Uncomfortable	75	26.2%

Source: Field Survey Data analyzed in IBM SPSS (2025)

However, only 24.1% of users rate their overall comfort level as "Very Comfortable" (Table 5), while more than half report neutrality or discomfort. This perception is further linked to how frequently respondents use these spaces. As shown in Table 8, a Chi-square test ($p = .014$) reveals a statistically significant relationship between comfort level and visit frequency, indicating that perceived discomfort discourages frequent use.

TABLE 6

Frequency Table of Frequency of Visits

	N (Number of respondents)	**%**
Daily	25	8.7%
2 – 3 times a week	72	25.2%
Once a week	64	22.4%
Once a month	47	16.4%
Rarely	78	27.3%

Source: Field Survey Data analyzed in IBM SPSS (2025)

Most respondents use the spaces infrequently, with 27.3% visiting rarely and only 8.7% using them daily. Weekly users make up 47.6%, indicating moderate engagement overall. This suggests that current space conditions may not strongly encourage regular use.

TABLE 7

Overall Comfort Level of the Space * Frequency of Visit Crosstabulation

		Frequency of Visit					Total
		Daily	2 – 3 times a week	Once a week	Once a month	Rarely	
Overall Comfort Level of the Space	Very comfortable	9	12	10	17	21	69
	Somewhat comfortable	2	24	19	4	18	67
	Neutral	10	20	13	13	19	75
	Uncomfortable	4	16	22	13	20	75
Total		25	72	64	47	78	286

Source: Field Survey Data analyzed in IBM SPSS (2025)

Users who find the spaces "very comfortable" tend to visit more frequently, while those who rate them "uncomfortable" are more likely to visit rarely. This suggests a clear link between comfort and frequency of use; better comfort encourages regular engagement.

TABLE 8

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	25.186[a]	12	.014
Likelihood Ratio	26.839	12	.008
Linear-by-Linear Association	.027	1	.869
N of Valid Cases	286		
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.86.			

Source: Field Survey Data analyzed in IBM SPSS (2025)

TABLE 9

Analysis, Correlation, or trend between space type and comfort perception

		Type of Youth Space Visited	Overall Comfort Level of the Space
Type of Youth Space Visited	Pearson Correlation	1	.097
	Sig. (2-tailed)		.100
	N	286	286
Overall Comfort Level of the Space	Pearson Correlation	.097	1
	Sig. (2-tailed)	.100	
	N	286	286

Source: Field Survey Data analyzed in IBM SPSS (2025)

This relationship reflects Anake & Nnamani (2023), who argued that acoustic and thermal discomfort in inflexible multipurpose spaces reduces sustained engagement. While the weak Pearson correlation ($r = .097$, $p = .100$ in Table 9) suggests no strong linear relationship between space type and comfort, observational data highlight systemic discomfort in vocational centers. This discrepancy implies that qualitative factors (e.g., rigid layouts, poor ventilation) may mediate comfort perceptions beyond typological categorizations. Agmada & Ismaila (2025) reinforce this by showing how rigid layouts in multipurpose environments hinder space optimization, suggesting that user-centered designs should accommodate variable zoning and multi-modal activities to improve comfort and use consistency.

Analysis for Objective 3

Objective 3: To identify user-proposed design interventions to optimize IEQ in these spaces.

TABLE 10

Frequency of Satisfaction level of multipurpose spaces

Factor	N (Number of respondents)	%
Satisfaction level of Space adaptability		
Very Satisfied	91	31.8%
Neutral	90	31.5%
Not Satisfied	105	36.7%
Satisfaction level of the Seating arrangement		
Very Satisfied	90	31.5%
Neutral	110	38.5%
Not Satisfied	86	30.1%
Satisfaction: Lighting Conditions		
Very Satisfied	74	25.9%
Neutral	88	30.8%
Not Satisfied	124	43.4%
Total	286	100%

Source: Field Survey Data analyzed in IBM SPSS (2025)

Users demanded flexible layouts (36.4%, Table XI), yet the FCT Youth Support Centre's rigid multipurpose hall (Plate 2) lacked movable partitions or modular furniture. This mismatch explains low satisfaction with spatial adaptability (36.7%, Table X) and echoes Agmada & Ismaila's (2025) critique of inflexible Nigerian public spaces. Meanwhile, Table 11 highlights top user-suggested improvements, including better ventilation (39.2%), flexible/multipurpose layouts (36.4%), and better seating (36.4%). These findings further stress the demand for spaces that support spatial transformation through modular furniture, reconfigurable layouts, and ventilation enhancements. This is supported by Lolli et al. (2022), who identified flexibility, natural lighting, and acoustic zoning as core principles of successful youth activity space design internationally.

TABLE 11

Suggested improvements or design ideas

		Responses		Percent of Cases
		N	Percent	
Suggested improvements or design ideas[a]	Better seating arrangements	104	24.8%	36.4%
	More ventilation openings	112	26.7%	39.2%
	Improved lighting systems	100	23.8%	35.0%
	More flexible and multipurpose spaces	104	24.8%	36.4%
Total		420	100.0%	146.9%
a. Dichotomy group tabulated at value 1.				

Source: Field Survey Data analyzed in IBM SPSS (2025)

Additionally, ventilation and lighting dissatisfaction resonate with earlier findings in Table 2, validating the need for integrated design interventions. Recommendations from Omeokachie et al. (2024), which emphasize daylight optimization, cross ventilation, and task-specific lighting, are therefore highly applicable. Table 12, which depicts high levels of user agreement on the need for natural lighting, ventilation, and solar panels, suggests a strong user preference for sustainable solutions. These responses justify the use of solar PV, daylight harvesting, and stack-driven ventilation systems in future architectural retrofits and new designs.

TABLE 12

Frequency of Agreement Among Respondents

Factor	**N (Number of respondents)**	**%**
Agreement: Adequate Natural Lighting		
Agree	60	21.0%
Neutral	130	45.5%
Disagree	42	14.7%
Strongly Disagree	54	18.9%
Agreement: Effective Ventilation for Heat Reduction		
Agree	69	24.1%
Neutral	94	32.9%
Disagree	70	24.5%
Strongly Disagree	53	18.5%
Agreement: Solar Panels Would Improve Energy Supply		
Agree	69	24.1%
Neutral	116	40.6%
Disagree	57	19.9%
Strongly Disagree	44	15.4%
Total	286	100%

Source: Field Survey Data analyzed in IBM SPSS (2025)

Case Study Observations

i. Case Study 1: FCT Youth Support Centre, Abuja

Observations at the FCT Youth Support Centre (Plate 2) revealed sealed windows and reliance on air conditioning, which users cited as key reasons for thermal dissatisfaction (32.9%, Table II), addressing Objective 1. This aligns with Mustapha et al. (2023), who noted that mechanical cooling systems in Nigerian public spaces often fail during power outages, exacerbating discomfort. Despite renovations, the multipurpose hall lacked operable windows or movable partitions, features prioritized by users (39.2% ventilation demand, 36.4% flexible layouts; Table XI).

ii. Case Study 2: Onikan Youth Centre, Lagos

The Onikan Youth Centre's rigid multipurpose hall (Plate 1) featured fixed seating and poor acoustics, contrasting sharply with user demands for adaptable spaces (36.4%, Table XI). This explains why 26.2% of users rated similar spaces as uncomfortable (Table V). While Abuja is this study's focus, the Lagos case underscores systemic issues in Nigerian urban youth spaces, such as over-reliance on mechanical cooling during renovations, a design pitfall critiqued by Lolli et al. (2022). While Abuja remains the primary focus, the Onikan Youth Centre in Lagos illustrates broader regional trends. For instance, its renovation efforts prioritized aesthetics over passive cooling, a recurring issue in Nigerian urban youth spaces.

To contextualize the reported discomfort levels, it's essential to compare the user feedback with established indoor environmental quality (IEQ) standards. The following checklist highlights key parameters, the recommended standards, and the corresponding findings from this study.

TABLE 13

Comparison of IEQ Parameters with ASHRAE Standards with Study Findings

S/N	**Parameter**	**ASHRAE Standard**	**Study Findings**
1	Thermal Comfort	ASHRAE 55 recommends an operative temperature range of 20–24°C for sedentary activities.	32.9% of users reported dissatisfaction with thermal comfort.
2	Ventilation/Air Quality	ASHRAE 62.1 specifies minimum ventilation rates to ensure acceptable indoor air quality.	42.3% of users were dissatisfied with indoor air quality.
3	Lighting Conditions	While ASHRAE standards focus less on lighting, adequate illumination is crucial for occupant comfort and productivity.	43.4% of users expressed dissatisfaction with lighting conditions.
4	Spatial Adaptability	Flexible space design is recommended to accommodate various activities and user needs.	36.7% of users were dissatisfied with the adaptability of spaces.
5	Seating Arrangements	Ergonomic and flexible seating is essential for comfort in multipurpose spaces.	30.1% of users reported dissatisfaction with seating arrangements.

Source: Field Survey Data analyzed in IBM SPSS (2025)

This study relies on user perceptions rather than physical IEQ measurements (e.g., temperature, CO2 levels). Future work should validate subjective feedback against sensor data. Dissatisfaction with thermal comfort (32.9%) aligns with Abuja's hot-humid climate, where temperatures often exceed ASHRAE's 20–24°C range, underscoring the need for passive cooling. And also, User dissatisfaction with lighting (43.4%) and ventilation (42.3%) persists across multiple metrics (Tables II, X), reflecting systemic design flaws. These align with Omeokachie et al. (2024), who advocate daylight optimization and cross-ventilation in Nigerian public spaces. This study's reliance on self-reported data may introduce response bias, but the comparison above underscores a notable gap between user experiences in Abuja's youth-focused spaces and international IEQ standards. Future research should integrate sensor-based assessments.

CONCLUSION AND RECOMMENDATIONS

This study reveals significant deficiencies in the environmental and functional performance of youth spaces in Abuja, particularly concerning thermal comfort, spatial flexibility, and indoor air quality. The results demonstrate that users' spatial experiences and frequency of engagement are directly influenced by these factors, pointing to a critical mismatch between current design approaches and user needs. Despite a wide range of activities occurring in these spaces, most centers lack the adaptive capacity to support functional diversity, leading to discomfort, reduced satisfaction, and underutilization. These findings underscore the necessity of adopting user-centered, climate-responsive design strategies that prioritize passive ventilation, daylighting, flexible spatial configurations, and energy independence. Enhancing these elements is essential to improving comfort, supporting diverse youth activities, and ensuring the long-term relevance and performance of youth-focused spaces in Sub-Saharan Africa.

Based on empirical findings and user feedback, the following recommendations are proposed to guide the design and retrofitting of youth activity spaces for improved performance and user comfort.

i. Thermal Comfort Enhancements: Implement passive cooling strategies such as cross-ventilation, use of thermal mass, and shading devices to maintain indoor temperatures within the recommended range.
ii. Improved Ventilation: Upgrade ventilation systems to meet or exceed ASHRAE 62.1 standards, ensuring adequate air exchange rates to improve indoor air quality.
iii. Lighting Improvements: Incorporate daylighting strategies and energy-efficient lighting solutions to enhance visual comfort and reduce energy consumption.
iv. Flexible Space Design: Redesign spaces to be adaptable for various activities, incorporating movable partitions and modular furniture to accommodate changing user needs.
v. Ergonomic Seating: Provide ergonomic and flexible seating options to improve comfort during different activities and durations of use.

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