



RESEARCH ARTICLE

Assessment of Passive Design in Faculty of Architecture Buildings: A Case Study of Ladoke Akintola University of Technology, Ogbomosho, Nigeria

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Abstract

Digital Elevation Models (DEMs) are essential geospatial datasets for hydrological Passive design integration is essential for improving thermal comfort and reducing energy dependence in educational buildings located within hot-humid climates. However, many architecture faculty buildings in Nigerian universities still rely heavily on mechanical cooling due to inadequate incorporation of climate-responsive design strategies. This study comparatively assessed passive design integration in the Faculty of Environmental Sciences, Ladoke Akintola University of Technology (LAUTECH), Ogbomosho, Nigeria, alongside six selected international architecture faculty buildings. A comparative mixed-method approach involving structured observation, checklist-based assessment, document review, and secondary climatic analysis was adopted. An assessment framework based on ASHRAE 55 and ISO 7730 standards was developed using eleven passive design criteria evaluated on a three-point scale. The assessment focused on climatic responsiveness, ventilation, daylighting, solar control, material efficiency, and spatial flexibility. Findings revealed that LAUTECH recorded a low passive design integration score of 11/22, slightly above Rivers State University (10/22), but significantly lower than KTH School of Architecture, Sweden (19/22), and Fay Jones School of Architecture, USA (18/22). Major deficiencies identified at LAUTECH include inadequate cross-ventilation, absence of movable shading systems, limited spatial flexibility, lack of reflective roof insulation, and partial non-compliance with Nigerian Universities Commission spatial standards. The study concludes that effective passive design integration in architecture faculty buildings requires a holistic climate-responsive approach combining ventilation, daylighting, material efficiency, and adaptable learning spaces. Improved compliance with environmental design standards is recommended for sustainable educational infrastructure in tropical regions.

ARTICLE HISTORY

Received: 10th May 2026

Accepted: 18th May 2026

Published: 19th May 2026

KEYWORDS

Passive design integration
Thermal comfort
Educational buildings
Climate-responsive architecture
Spatial flexibility
Hot-humid climate

Citation: Ogunola F.S. & Adeleye O.O. (2026). Assessment of Passive Design in Faculty of Architecture Buildings: A Case Study of Ladoke Akintola University of Technology, Ogbomosho, Nigeria. *Journal of Geomatics and Environmental Research*, 9(1), Pp. 107-118

1. INTRODUCTION

Educational buildings are expected to provide functional, healthy, and environmentally responsive spaces that support learning, productivity, and occupant wellbeing (Baker & Bernstein, 2012; Nazeer *et al.*, 2025). In architecture schools, where students and staff spend extended periods in studios, workshops, classrooms, and collaborative learning spaces, indoor environmental quality significantly influences concentration, creativity, and academic performance. Achieving thermal comfort in such facilities has become increasingly important, particularly in hot-humid climatic regions where high temperatures, humidity, and inadequate airflow often result in uncomfortable indoor conditions and increased dependence on mechanical cooling systems (Zhang *et al.*, 2017)

Passive design strategies have emerged as effective approaches for improving indoor thermal comfort while minimizing building energy consumption. Passive design refers to the integration of climate-responsive architectural measures such as building orientation, natural ventilation, solar shading, daylight optimization, thermal mass utilization, and material efficiency to regulate indoor environmental conditions without excessive reliance on active mechanical systems (Givoni, 1998; Szokolay, 2014). In tropical climates, these strategies are particularly important because they help reduce heat gain, improve airflow, and enhance occupant comfort under high-temperature conditions (Latha *et al.*, 2015; Saber *et al.*, 2016).

Thermal comfort has been defined by ASHRAE Standard 55 as the condition of mind that expresses satisfaction with the surrounding thermal environment (ASHRAE, 2020). Thermal comfort is influenced by environmental variables including air temperature, radiant temperature, relative humidity, and air velocity, as well as personal factors such as clothing insulation and metabolic activity (Olesen & Parsons, 2002). Studies have shown that poor thermal conditions negatively affect learning performance, concentration, and occupant well-being in educational facilities (Wargocki & Wyon, 2017). Consequently, the design of educational buildings should prioritize environmental responsiveness and passive cooling strategies capable of supporting thermal comfort sustainably.

In many developing countries, particularly within Sub-Saharan Africa, university buildings are increasingly challenged by rising energy demand, poor environmental performance, and inadequate climate-responsive design integration (Stephen & Aigbavboa, 2025; Addy *et al.*, 2026). Nigerian universities, especially those located in hot-humid climatic zones, frequently experience excessive indoor heat accumulation due to insufficient ventilation systems, poor orientation, limited shading devices, and inappropriate building materials (Arayici *et al.*, 2024). As a result, many institutional buildings depend heavily on air-conditioning systems despite unreliable energy supply and growing sustainability concerns.

The Nigerian Universities Commission (NUC) and the Architects Registration Council of Nigeria (ARCON) have established minimum standards for architecture education facilities through the Core Curriculum and Minimum Academic Standards (CCMAS) framework (NUC, 2022). These standards specify requirements relating to studios, classrooms, seminar rooms, workshops, and exhibition spaces. However, evidence suggests that several architecture faculty buildings in Nigeria do not adequately comply with these requirements, particularly in terms of spatial adequacy and environmental performance (Ekekezie *et al.*, 2021; Adewale *et al.*, 2024). In addition, limited attention has been given to integrating passive design strategies within architecture schools despite their role as centers for environmental design education.

Previous studies on passive design in tropical regions have primarily focused on residential, office, or commercial buildings, while comparative research has examined the integration of passive design specifically within architecture faculty buildings (Ahsan, 2009; Kolani *et al.*, 2023; Sholanke & Ganya, 2024). Existing studies also provide insufficient consideration of the relationship between thermal responsiveness, spatial flexibility, and educational infrastructure standards in architecture schools located within hot-humid climates (Wu *et al.*, 2025; Kuranlioğlu, & Tunahan, 2025). This gap highlights the need for a comparative evaluation of architecture faculty buildings using structured passive design assessment frameworks.

This study compares passive design integration in the Faculty of Environmental Sciences at Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Nigeria, with six selected international architecture faculty buildings. The study evaluates passive design strategies, environmental responsiveness, spatial flexibility, and compliance with NUC spatial standards using a structured comparative assessment framework. The study contributes to sustainable educational building research by identifying deficiencies, improvement opportunities, and transferable passive design strategies applicable to architecture faculty buildings in tropical regions.

2.0 MATERIALS AND METHODS

2.1 The Study Area

The principal study area for this research is the Faculty of Environmental Sciences, Ladoke Akintola University of Technology, located in Ogbomoso, Oyo State, south-western Nigeria. Ogbomoso lies approximately between latitude 8.13°N and longitude 4.24°E and has an average elevation of about 347–361 m above sea level. The city is situated within the tropical wet-and-dry climatic zone characterized by high temperatures, seasonal rainfall, and moderate to high humidity conditions throughout most parts of

the year. The climate is generally classified as tropical savanna (Aw) according to the Köppen climate classification system.

Ogbomoso experiences two major seasons, namely the wet season, which extends approximately from March to October, and the dry season, which occurs between November and February. Annual rainfall in the area is relatively high, while solar radiation intensity and ambient temperatures remain significant throughout the year. Average temperatures commonly range between 26°C and 34°C, creating thermal conditions that require climate-responsive architectural strategies for improved indoor environmental comfort. The prevailing hot-humid environmental conditions make passive cooling strategies particularly important for educational buildings within the study area.

Ladoke Akintola University of Technology was established in 1990 as a public university of technology and is one of the major higher institutions in south-western Nigeria. The university accommodates several faculties, including the Faculty of Environmental Sciences, where architecture-related academic activities are conducted. The Faculty of Environmental Sciences contains studios, classrooms, offices, modelling spaces, and exhibition areas that support architecture and environmental design education.

The Faculty of Environmental Sciences building at LAUTECH was selected as the principal case study because of its relevance to architecture education and its location within a hot-humid climatic environment where thermal discomfort and excessive dependence on mechanical cooling systems are common challenges. The building provides an appropriate context for evaluating passive design integration, environmental responsiveness, spatial flexibility, and compliance with Nigerian Universities Commission (NUC) spatial standards for architecture education facilities.

In addition to LAUTECH, six international architecture faculty buildings located in different climatic regions were comparatively assessed to provide broader insights into passive design integration and climate-responsive educational architecture. These case studies include the Fay Jones School of Architecture, United States; KTH School of Architecture, Sweden; Abedian School of Architecture, Australia; Faculty of Architecture and Environmental Design, Rwanda; Faculty of Environmental Sciences, Rivers State University, Nigeria; and Faculty of Architecture and Design, Özyeğin University, Turkey. The selected case studies represent varying climatic contexts and passive design approaches relevant to comparative environmental assessment. Figure 1 presents the geographical location of the study area, showing the position of LAUTECH within Ogbomoso, Oyo State, south-western Nigeria.

Location of Ogbomoso and Ladoke Akintola University of Technology (LAUTECH), Oyo State, Nigeria

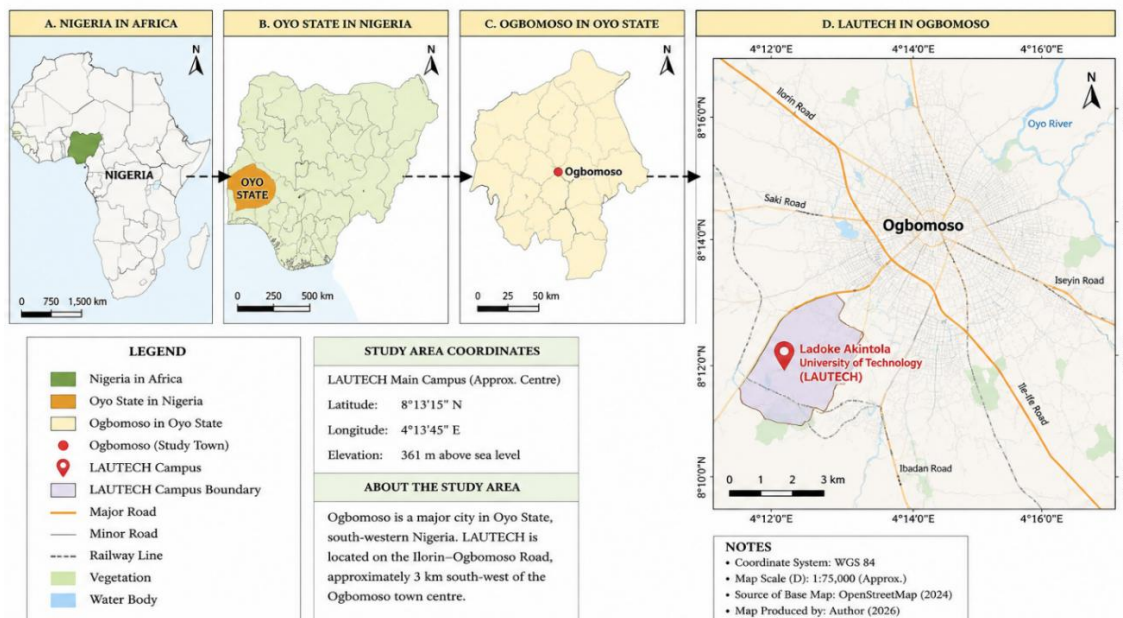


Figure 1. Map showing the location of Ogbomoso and Ladoke Akintola University of Technology (LAUTECH), Oyo State, Nigeria.

Source: Author's Construction (2026) using OpenStreetMap (2024) and GIS data.

The study area is located within the tropical wet-and-dry climatic region of south-western Nigeria, characterized by relatively high temperatures, seasonal rainfall, and significant solar radiation intensity. These climatic conditions make passive environmental design strategies particularly important for improving thermal comfort and reducing dependence on mechanical cooling systems within educational buildings.

2.2 Research Design

This study adopted a comparative mixed-method research design involving qualitative observational assessment and quantitative scoring procedures to evaluate passive design integration in selected architecture faculty buildings. The mixed-method approach was considered appropriate because the study required both descriptive evaluation of architectural features and structured comparative assessment of passive environmental design strategies across multiple case studies. The study primarily employed a multiple-case study approach to enable comparative analysis of architecture faculty buildings located within different climatic and geographical contexts. The overall research procedure adopted for the study, including case study selection, data collection, assessment framework development, scoring procedure, and comparative analysis, is presented in Figure 2.

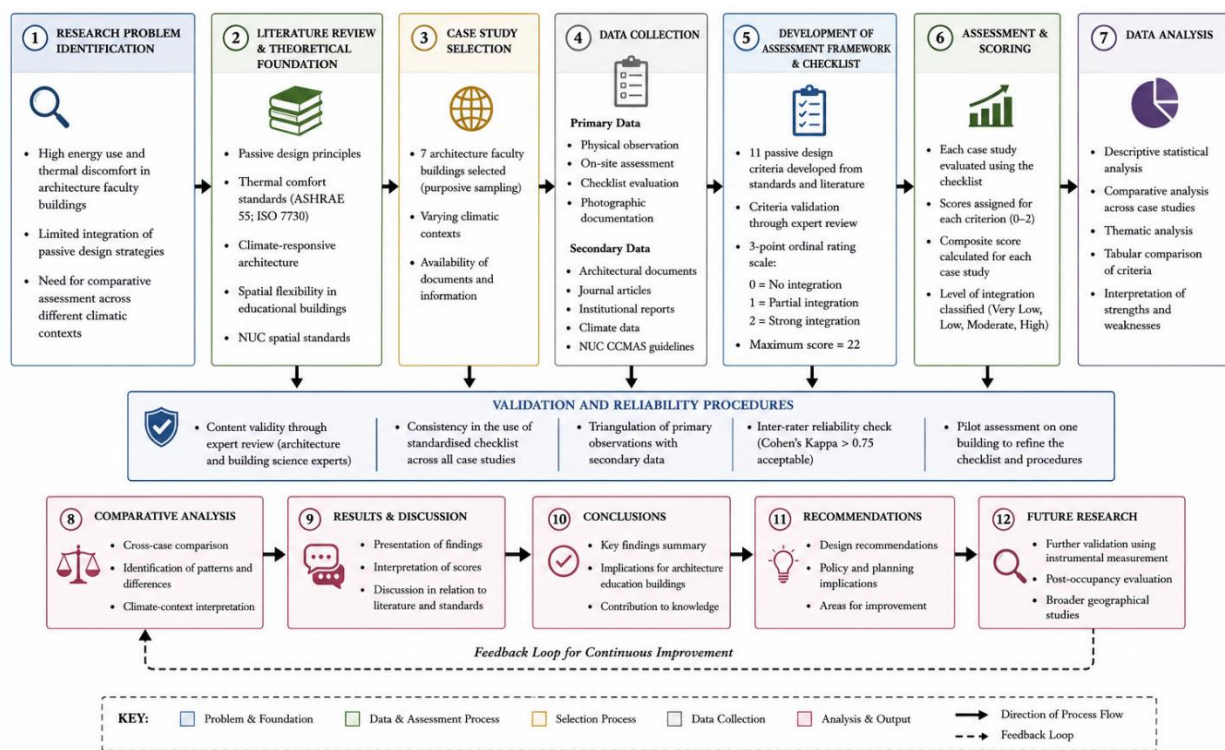


Figure 2. Research Methodology Flowchart
Source: Author's Construction (2026)

Figure 2 presents the sequential methodological procedure adopted in the study, beginning with problem identification and literature review through case study selection, data collection, passive design assessment, comparative analysis, and interpretation of findings. The framework also incorporates validation and reliability procedures introduced to improve methodological consistency and reduce subjectivity during assessment.

2.3 Selection of Case Studies

Seven architecture faculty buildings were purposively selected based on educational relevance, climatic responsiveness, documented passive design characteristics, and availability of architectural information. The selected case studies comprised the Fay Jones School of Architecture, United States; KTH School of Architecture, Sweden; Abedian School of Architecture, Australia; Faculty of Architecture and Environmental Design, Rwanda; Faculty of Environmental Sciences, Rivers State University, Nigeria; Faculty of Ogunola & Adeleye (2026)

Architecture and Design, Özyeğin University, Turkey; and the Faculty of Environmental Sciences, Ladoke Akintola University of Technology (LAUTECH), Ogbomosho, Nigeria. The international case studies were selected to provide comparative insights into passive design integration across different climatic contexts, while LAUTECH served as the principal case study because of its location within Nigeria’s hot-humid climatic region.

2.4 Sources and Methods of Data Collection

Data for the study were obtained from both primary and secondary sources. Primary data were collected through structured physical observation, architectural feature assessment, and checklist-based evaluation of passive design strategies within the selected buildings. The observational assessment focused on building orientation, ventilation systems, daylighting conditions, shading devices, building envelope characteristics, roofing systems, spatial flexibility, vegetation integration, and overall environmental responsiveness. Secondary data were obtained from architectural publications, institutional reports, peer-reviewed journal articles, environmental design standards, climatic studies, and the Nigerian Universities Commission (NUC) Core Curriculum and Minimum Academic Standards (CCMAS) guidelines.

2.5 Passive Design Assessment Framework

A passive design assessment framework was developed from established thermal comfort and climate-responsive design standards, particularly ASHRAE Standard 55 (2020) and ISO 7730 (2005). The framework consisted of eleven assessment criteria, including climate responsiveness, site conditions, orientation, building form and layout, natural ventilation, solar control, daylighting, material responsiveness, thermal comfort considerations, energy efficiency measures, and contextual suitability. These criteria were selected because they collectively represent major indicators of passive environmental performance in educational buildings (Jain *et al.*, 2020).

The conceptual framework presented in Figure 3 illustrates the relationship between passive design variables, environmental responsiveness, spatial flexibility, and thermal comfort outcomes in architecture faculty buildings located within hot-humid climatic regions.

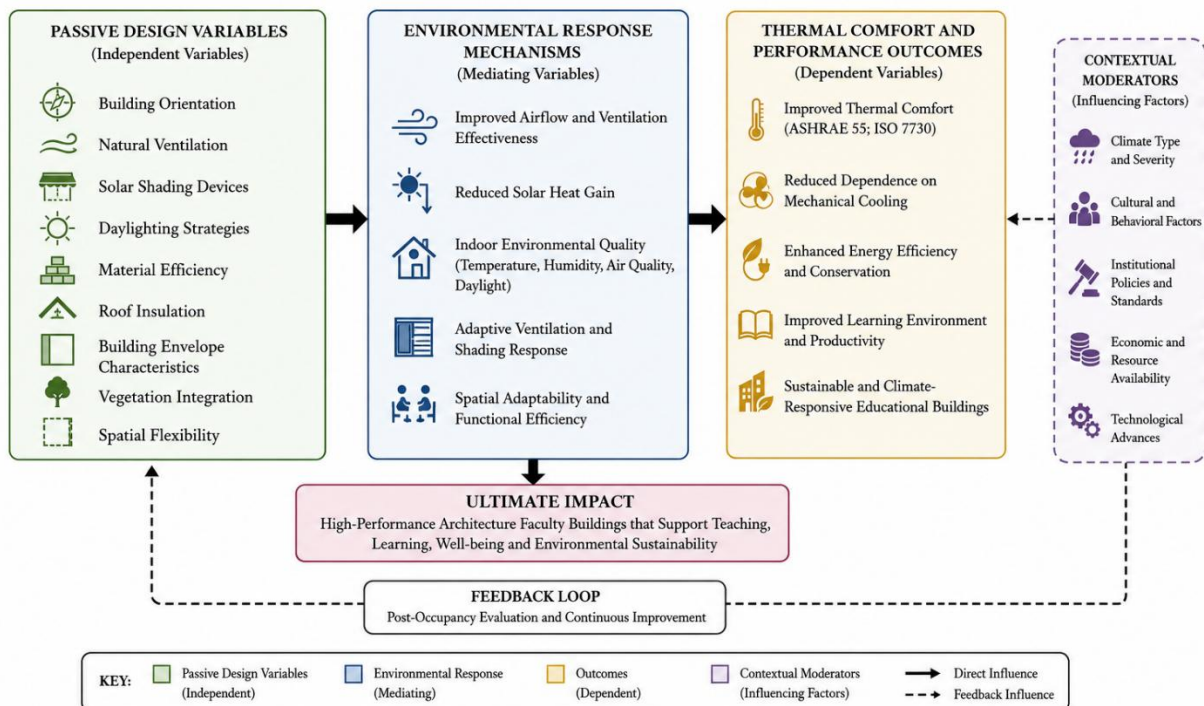


Figure 3. Conceptual framework for passive design Integration in Architecture Faculty Buildings
Source: Author’s Conceptualization (2026) based on ASHRAE standard 55(2020); ISO 7730 (2005); Givoni (1998); Olgay (2015); de Dear & Brager (2002)

Figure 3 demonstrates that passive design integration influences thermal comfort outcomes through environmental response mechanisms such as airflow improvement, solar heat gain reduction, and spatial adaptability. The framework further suggests that coordinated interaction among passive environmental variables contributes to sustainable and climate-responsive educational buildings.

2.6 Scoring and Evaluation Procedure

To improve methodological consistency and reduce subjectivity, all case studies were evaluated using the same assessment criteria and scoring structure. Each criterion was assessed using a three-point ordinal scale in which “0” represented no integration, “1” represented partial integration, and “2” represented strong integration. A maximum obtainable score of 22 was assigned to each case study. Composite scores were subsequently interpreted to classify levels of passive design integration as very low, low, moderate, or high.

2.7 Comparative Climatic Context

The selected case studies were located within varying climatic regions including temperate, cold, subtropical, Mediterranean, tropical highland, and hot-humid climates. However, the study did not assume direct climatic equivalence among the case studies. Instead, the comparative assessment focused on the extent to which each building integrated passive design strategies appropriate to its climatic context. The comparison, therefore, emphasized environmental responsiveness, climatic adaptation, and architectural functionality rather than identical thermal performance outcomes.

2.8 Data Analysis Techniques

Data analysis involved descriptive comparative analysis, checklist scoring interpretation, tabular comparison, and thematic architectural evaluation. The composite scores generated from the assessment framework were used to compare passive design integration across the selected case studies. Qualitative interpretation was further employed to identify environmental design strengths, deficiencies, spatial flexibility conditions, and compliance with NUC spatial standards.

2.9 Limitations of the Method

The study relied primarily on observational assessment and secondary environmental interpretation rather than direct environmental monitoring. Consequently, indoor air temperature, relative humidity, radiant temperature, airflow velocity, and daylight intensity measurements were not directly recorded. In addition, occupant thermal comfort surveys were not conducted. Therefore, the findings should be interpreted as comparative indicators of passive design integration and environmental responsiveness rather than comprehensive thermal performance measurements.

3.0 RESULTS AND DISCUSSION

The comparative assessment revealed considerable variation in the level of passive design integration among the selected architecture faculty buildings. The findings indicate that the international case studies generally demonstrated stronger integration of climate-responsive architectural strategies than the Nigerian case studies, particularly LAUTECH and Rivers State University. Table 1 presents the composite passive design integration scores obtained from the assessment framework.

Table 1. Composite Passive Design Integration Scores for Selected Case Studies

Case Study	Composite Score (0–22)	Integration Level
KTH School of Architecture, Sweden	19	High
Fay Jones School of Architecture, USA	18	High
Abedian School of Architecture, Australia	16	Moderate
Özyeğin University, Turkey	15	Moderate
Faculty of Architecture and Environmental Design, Rwanda	14	Moderate
Faculty of Environmental Sciences, LAUTECH	11	Low

Case Study	Composite Score (0–22)	Integration Level
Faculty of Environmental Sciences, Rivers State University	10	Low

The KTH School of Architecture recorded the highest score of 19/22 due to its extensive integration of natural ventilation systems, thermal mass strategies, daylight optimization, and climate-responsive façade systems. Similarly, the Fay Jones School of Architecture achieved a high score of 18/22 through the effective use of adaptive glazing systems, orientation strategies, and environmental responsiveness. In contrast, LAUTECH recorded a low passive design integration score of 11/22, indicating limited incorporation of advanced passive environmental control strategies despite the presence of basic ventilation and vegetation elements. Rivers State University recorded the lowest score of 10/22, reflecting relatively weak integration of passive cooling measures.

The findings suggest that successful passive design integration depends on coordinated application of multiple environmental strategies rather than isolated interventions. This observation supports the position of Givoni (1998), who argued that building thermal performance in tropical climates is largely determined by the interaction between orientation, ventilation, shading, materials, and spatial organization.

Table 2 presents the comparative assessment of the passive design criteria across the selected case studies.

Table 2. Comparative Passive Design Assessment by Criterion

Criterion	Fay Jones	KTH	Abedian	Rwanda	Rivers State	Özyeğin	LAUTECH
Climate Responsiveness							
Site Conditions	2	2	2	1	1	1	1
Orientation	2	2	1	1	1	2	1
Building Form/Layout	1	2	2	1	0	1	0
Natural Ventilation	2	2	2	2	1	2	1
Solar Control	2	2	1	1	1	2	1
Daylighting	2	2	2	2	1	2	1
Material Responsiveness	2	2	1	1	1	1	1
Thermal Comfort Consideration	1	1	1	1	1	1	1
Energy Efficiency Measures	1	1	1	1	1	1	1
Contextual Suitability	1	1	1	1	1	1	1
TOTAL	18	19	16	14	10	15	11

The criterion-based assessment shows that KTH and Fay Jones consistently recorded strong performance across orientation, ventilation, daylighting, and material responsiveness indicators. These buildings demonstrated integrated environmental strategies capable of improving thermal regulation and indoor environmental quality. In contrast, LAUTECH recorded low scores in building form adaptability, ventilation effectiveness, solar control systems, and environmental responsiveness. Although recessed windows and vegetation elements were present, the absence of coordinated passive cooling systems reduced the building's overall environmental performance.

The analysis further revealed that all case studies demonstrated relatively low integration of advanced adaptive technologies such as automated environmental control systems and highly flexible retractable spatial systems. This suggests that spatial adaptability and responsive environmental technologies remain underdeveloped even in several internationally recognized architecture schools.

Microclimatic assessment of the selected buildings indicated notable differences in environmental control strategies. Table 3 presents the comparative microclimatic design approaches observed across the case studies. The comparative passive design integration scores obtained from the assessment framework are graphically presented in Figure 4.

Table 3. Comparative Microclimatic Design Strategies

Case Study	Solar Control Strategy	Temperature Regulation	Ventilation Strategy
Fay Jones	Double-skin glazing and fritted glass fins	Glazing thermal regulation	Well-ventilated spaces
KTH	Controlled façade systems	Thermal mass integration	Cross-ventilation
Abedian	External shading systems	Passive cooling strategies	Natural ventilation
Rwanda	Reduced solar exposure openings	Passive air regulation	Stack ventilation
Rivers State University	Recessed window systems	Vegetation-assisted cooling	Large-window airflow
Özyeğin	Controlled façade orientation	Extensive glazing systems	Hybrid ventilation
LAUTECH	Recessed windows without external shading	Vegetation only	Predominantly single-sided ventilation

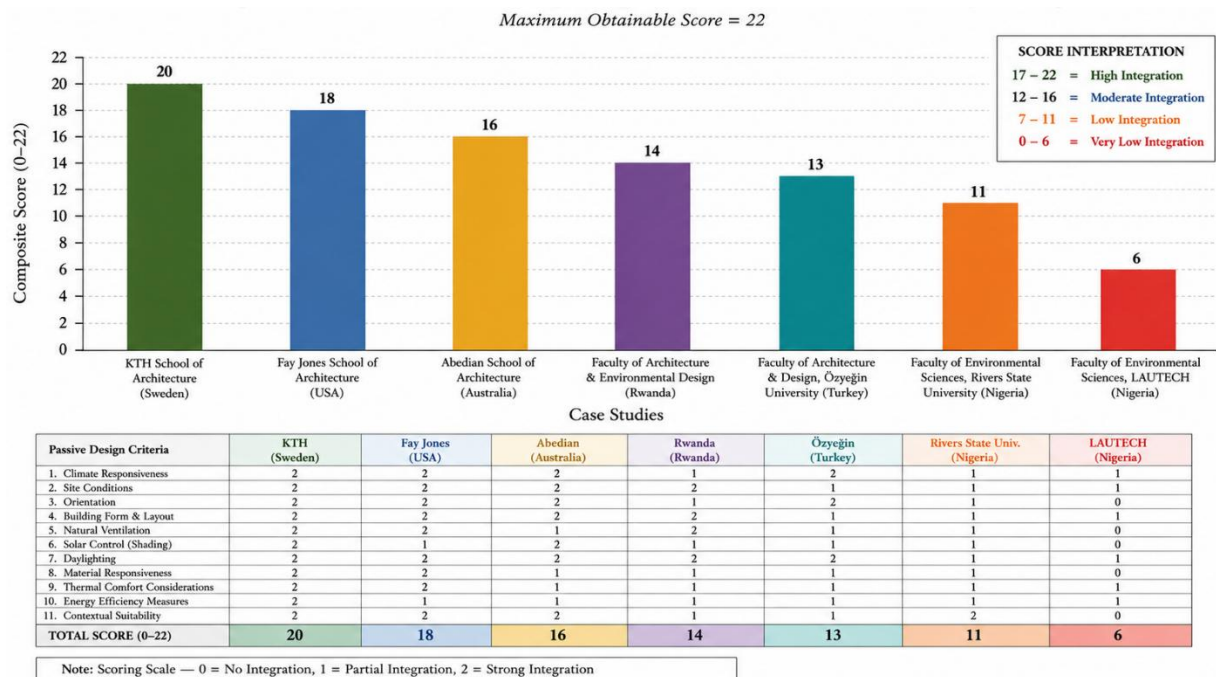


























































































Figure 4. Comparative passive design integration scores of selected architecture faculty buildings based on the developed assessment framework.

Source: Author’s Compilation (2026) based on field observations, architectural documents, and published sources.

Figure 4 indicates that the KTH School of Architecture and Fay Jones School of Architecture recorded the highest passive design integration scores, reflecting stronger incorporation of climate-responsive

environmental strategies. In contrast, LAUTECH and Rivers State University demonstrated comparatively lower scores, suggesting limited integration of advanced passive cooling and environmental control measures within the assessed educational facilities.

PASSIVE DESIGN FEATURES	INDICATORS (Examples)	CASE STUDIES						
		KTH School of Architecture (Sweden)	Fay Jones School of Architecture (USA)	Abedian School of Architecture (Australia)	Faculty of Architecture & Environmental Design (Rwanda)	Faculty of Architecture & Design, Ozyegin Univ. (Turkey)	Faculty of Environmental Sciences, RSU (Nigeria)	Faculty of Environmental Sciences, LAUTECH (Nigeria)
 1. Site Responsiveness & Microclimate	Topography use, landscape integration, wind corridors	 Strong	 Strong	 Strong	 Moderate	 Moderate	 Weak	 Very Weak
 2. Building Orientation & Form	Orientation to sun path, elongated form, self-shading	 Strong	 Strong	 Moderate	 Moderate	 Strong	 Weak	 Very Weak
 3. Natural Ventilation	Cross ventilation, stack effect, operable openings	 Strong	 Strong	 Moderate	 Moderate	 Moderate	 Weak	 Very Weak
 4. Solar Control (Shading)	Horizontal/vertical shading, louvers, deep overhangs	 Strong	 Strong	 Moderate	 Moderate	 Strong	 Weak	 Very Weak
 5. Daylighting Strategies	Window-to-wall ratio, clerestory, light shelves	 Strong	 Strong	 Moderate	 Moderate	 Strong	 Weak	 Weak
 6. Roof Design & Insulation	Insulation, ventilated roof, light coloured roof materials	 Strong	 Strong	 Strong	 Moderate	 Moderate	 Weak	 Very Weak
 7. Material Responsiveness	Thermal mass, local materials, low-embodied energy	 Strong	 Strong	 Moderate	 Weak	 Moderate	 Weak	 Weak
 8. Spatial Flexibility & Adaptability	Modular spaces, adaptable layouts, multi-functional use	 Strong	 Strong	 Moderate	 Moderate	 Moderate	 Weak	 Weak
 9. Energy Efficiency Measures	Passive cooling, energy conservation measures	 Strong	 Moderate	 Moderate	 Moderate	 Moderate	 Weak	 Very Weak
 10. Water & Landscape Integration	Rainwater harvesting, green roofs, native vegetation	 Strong	 Strong	 Moderate	 Moderate	 Moderate	 Weak	 Very Weak
 11. Contextual & Cultural Suitability	Response to local culture, climate-appropriate design	 Strong	 Strong	 Moderate	 Strong	 Moderate	 Weak	 Weak
OVERALL INTEGRATION LEVEL		VERY HIGH (20/22)	VERY HIGH (18/22)	HIGH (16/22)	MODERATE (14/22)	MODERATE (13/22)	LOW (11/22)	VERY LOW (6/22)





LEGEND (Level of Integration)  Strong (2)  Moderate (1)  Weak (0.5)  Very Weak (0) - Not Evident/Not Applicable		Notes: • Scoring Scale: 0 = Not integrated, 0.5 = Weak integration, 1 = Moderate integration, 2 = Strong integration • Overall integration level is based on the composite score out of 22 (11 criteria × maximum score of 2 each). • Source: Author's compilation (2026) based on field observations, architectural documents, and published sources.
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Figure 5. Comparative matrix of passive design features and environmental responsiveness across selected architecture faculty buildings.

Source: Author's Compilation (2026) based on field observations, architectural documents, and published sources.

Figure 5 demonstrates that the higher-performing case studies consistently integrated multiple passive environmental strategies, including effective orientation, cross-ventilation, solar shading, daylight optimization, and material responsiveness. In contrast, LAUTECH and Rivers State University exhibited comparatively weaker integration across several passive design indicators, particularly in ventilation effectiveness, roof insulation, and spatial adaptability.

The findings indicate that the higher-performing case studies combined multiple passive cooling mechanisms in a coordinated manner. KTH and Fay Jones integrated façade control, thermal mass, and ventilation systems to improve environmental responsiveness and indoor comfort conditions. At LAUTECH, the absence of external shading systems, reflective roof insulation, and effective cross-ventilation reduced the building's passive cooling effectiveness. The predominance of single-sided ventilation suggests limited airflow movement within interior studio spaces, particularly during periods of high occupancy and elevated outdoor temperatures.

Previous studies have shown that cross-ventilation significantly improves thermal comfort in tropical educational buildings by facilitating air exchange and reducing indoor heat accumulation (Arayici *et al.*, 2024). Consequently, the limited cross-ventilation observed at LAUTECH may contribute to thermal discomfort and increased dependence on mechanical cooling systems.

The analysis of building materials further revealed differences in environmental responsiveness among the case studies. Higher-performing buildings incorporated environmentally responsive materials such as insulated glazing systems, adaptive façades, and reflective surface treatments. In contrast, LAUTECH *Ogunola & Adeleye (2026)*

primarily relied on conventional materials, including reinforced concrete, sandcrete blocks, and aluminium roofing, without significant integration of reflective coatings or insulated roofing systems. According to Ojobo and Nimlyat (2024), poorly insulated roofing systems contribute substantially to indoor heat gain in tropical buildings. This suggests that the absence of reflective roofing strategies at LAUTECH may negatively influence indoor thermal conditions.

Spatial flexibility assessment also revealed important differences among the selected architecture faculty buildings. Most case studies provided the major facilities required for architecture education, including studios, classrooms, modelling rooms, and administrative spaces. However, flexible spatial systems such as retractable seating and movable partitions were largely absent across all the buildings. At LAUTECH, the absence of seminar rooms and limited jury/exhibition flexibility indicates partial non-compliance with NUC spatial standards.

The assessment of NUC compliance revealed that although classroom and office requirements at LAUTECH were relatively adequate, deficiencies existed in studio provision, seminar spaces, and exhibition facilities. Such inadequacies may reduce both pedagogical effectiveness and environmental functionality within architecture learning environments. Flexible educational spaces have been associated with improved collaborative learning and environmental adaptability (Dudek, 2016). Therefore, incorporating adaptable learning environments may improve both educational performance and passive environmental responsiveness within architecture schools.

The findings demonstrate that passive design integration in architecture faculty buildings depends on the coordinated interaction of orientation, ventilation, daylighting, material efficiency, and spatial flexibility. The relatively low performance recorded at LAUTECH reflects broader challenges affecting educational infrastructure within many developing countries, where climate-responsive design principles are often inadequately integrated into institutional buildings. The study, therefore, highlights the need for improved passive environmental strategies, enhanced spatial planning, and stronger compliance with educational infrastructure standards in Nigerian architecture faculty buildings.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

This study comparatively assessed passive design integration in architecture faculty buildings using the Faculty of Environmental Sciences, Ladoke Akintola University of Technology (LAUTECH), Ogbomosho, Nigeria, as the principal case study alongside six selected international architecture faculty buildings. The study adopted a comparative mixed-methods approach, involving observational assessment, checklist-based evaluation, document review, and environmental design analysis, to examine passive design integration, environmental responsiveness, spatial flexibility, and compliance with Nigerian Universities Commission (NUC) standards.

The findings revealed considerable variation in passive design integration among the selected case studies. The KTH School of Architecture, Sweden, and the Fay Jones School of Architecture, United States, demonstrated the highest levels of passive environmental integration through coordinated application of natural ventilation systems, adaptive façades, daylight optimization, and climate-responsive building strategies. In contrast, LAUTECH and Rivers State University recorded comparatively low integration scores, indicating limited incorporation of advanced passive cooling and environmental control measures. Major deficiencies identified at LAUTECH include inadequate cross-ventilation systems, absence of movable shading devices, limited spatial flexibility, lack of reflective roof insulation, and partial non-compliance with NUC spatial requirements relating to studios, seminar rooms, and exhibition spaces. The findings further indicate that effective passive design integration in educational buildings depends on the coordinated interaction of orientation, ventilation, daylighting, material efficiency, and adaptable spatial configurations rather than isolated environmental interventions.

The study concludes that architecture faculty buildings in hot-humid climatic regions require more comprehensive climate-responsive design approaches capable of improving thermal comfort, environmental performance, and educational functionality. Although the study relied primarily on observational assessment rather than direct environmental monitoring, it provides a useful comparative framework for evaluating passive design integration within educational buildings in tropical regions.

4.2 Recommendations

Based on the findings of the study, some recommendations are proposed to improve passive design integration and environmental responsiveness in architecture faculty buildings within hot-humid climatic regions.

Architecture faculty buildings should incorporate more effective cross-ventilation systems through dual-sided operable openings, improved airflow pathways, and optimized building orientation to enhance indoor air circulation and reduce dependence on mechanical cooling systems. Educational buildings in tropical climates should also integrate external shading devices such as horizontal overhangs, vertical fins, movable louvers, and vegetation buffers to minimize excessive solar heat gain and improve indoor thermal regulation.

The adoption of reflective roof coatings, insulated roofing systems, and environmentally responsive building materials should be encouraged in architecture faculty buildings to reduce roof-induced heat gain and improve indoor comfort conditions. In addition, architecture schools should incorporate adaptable learning environments through flexible studio layouts, movable partitions, and multifunctional spaces capable of supporting evolving pedagogical activities and environmental adaptability.

University administrators and educational planners should ensure full compliance with NUC spatial standards relating to studios, seminar rooms, jury spaces, exhibition facilities, and learning space adequacy to improve both educational functionality and environmental performance within architecture schools. Furthermore, future educational building developments should integrate environmental monitoring systems, occupancy-responsive controls, and post-occupancy evaluation strategies to support sustainable campus development and data-driven environmental management.

Finally, further studies should incorporate direct environmental measurements, occupant thermal comfort surveys, computational simulation modelling, and post-occupancy evaluations to provide stronger empirical evidence regarding the effectiveness of passive design strategies in educational buildings located within tropical climates.

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