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Impact of Climate Responsive Design Strategies on the Design of Youth Development Centre in Port Harcourt

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Abstract: Youth Development Centres served as important facilities for empowering young people through vocational training, entrepreneurship, recreation, and social engagement. However, many youth facilities in tropical regions like portharcourt faced challenges related to thermal discomfort, excessive energy consumption, inadequate ventilation, poor daylighting, and limited responsiveness to local climatic conditions. These challenges often reduced building performance and negatively affected user experience. Climate-responsive design emerged as a sustainable architectural approach that integrated environmental considerations into building planning and design to improve functionality, energy efficiency, and occupant well-being. This study examined the impact of climate-responsive design strategies on the design of Youth Development Centres in Port Harcourt, Nigeria. The study explored key strategies including building orientation, natural ventilation, daylight optimization, shading devices, landscape integration, courtyard planning, and passive cooling techniques. A qualitative research methodology involving literature review, observational studies, and comparative case study analysis was adopted. The findings revealed that climate-responsive design strategies significantly improved environmental performance, reduced operational costs, enhanced spatial quality, and promoted user comfort within youth facilities. The study concluded that integrating climate-responsive principles into the planning and design of Youth Development Centres could contribute to the creation of sustainable, adaptable, and user centered environments that support youth development activities in tropical regions.

Keywords: *Climate-Responsive Design, Youth Development Centre, Passive Design, Natural Ventilation, Sustainable Architecture.*

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I. INTRODUCTION

Youth Development Centres are increasingly recognized as vital social infrastructure that enables youths intellectual, vocational, entrepreneurial, and recreational development. In these facilities, youths can benefit from practical training programmes, educational initiatives, innovation activities, and building social networks. As the demand for youth related facilities increases, it becomes more important to ensure that these facilities are functional and sustainable in terms of their environmental design and operation. In developing countries like Nigeria, many Youth Development Centre lack climatic responsiveness resulting in building failures due to poor thermal performance, insufficient natural light, poor air quality, high energy use for heating and cooling, etc. Buildings consume significant amounts of the world's energy supply as indicated by the United Nations Environment Programme (2023). It is estimated that the construction sector accounts for one third of global greenhouse gas emissions and consumes over half of the world's generated electricity. Therefore, contemporary architecture must be sustainable. The term 'sustainable architecture' implies designing buildings that consider local environmental conditions such as temperature, humidity, rainfall, solar radiation, wind directions, etc., in order to optimize building performance and indoor environment quality. The focus on passive design measures that minimize dependency on artificial environmental controls is essential to achieve the desired results in sustainable architecture. Sustainable buildings have gained attention in recent years because of the increasing interest in environmental conservation practices. Climate responsive architecture involves designing buildings that take into account local climatic conditions in order to improve occupant satisfaction and building performance. Tropical regions present unique challenges for architects who need to consider temperature, humidity levels, and rainfall amount when designing buildings that perform optimally under these climatic conditions. Port Harcourt City located in the Niger Delta region of Nigeria features a tropical monsoon climate that is

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characterized by high temperatures, high humidity levels, and abundant rainfall. This particular climate presents many opportunities and challenges for climate responsive architecture. Poor climate responsiveness can lead to building failures and high energy use. Therefore, the need for passive environmental design in youth facilities becomes obvious in Port Harcourt City.

Several climate responsive measures are commonly used in tropical architecture today. These include building orientation and shape, cross ventilation, courtyard design, solar shading, green spaces, optimal daylighting, and use of renewable building materials. Recent research has confirmed that these measures are highly beneficial for buildings energy consumption, air quality, thermal comfort, etc. (Attia, 2022; Mahdavinejad et al., 2021; Olgyay & Serra, 2020). Furthermore, climate responsive design makes learning facilities more productive, innovative, healthy, and comfortable places for users. Climate-responsive designs of educational buildings became popular in recent decades due to the increased concern about sustainable architecture. Modern-day schools and universities are required to satisfy three major criteria of sustainable architecture: environmental consciousness, flexibility, and user-focused designs. Thus, climate-responsive designs offer great potential to architects who design social infrastructure for youth. This study seeks to investigate how passive design techniques can improve the design of Youth Development Centres in Port Harcourt.

➢ *Statement of the Problem*

According to the United Nations Human Settlements Programme (UN-Habitat, 2020), youth facilities play an important role in providing safe and inclusive environments that support learning, creativity, and community participation. Similarly, the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2021) emphasized that youth-oriented facilities must provide environments that enhance learning outcomes, social interaction, and skills acquisition while responding to contemporary environmental and technological demands.

Despite the growing importance of Youth Development Centres, several studies have identified deficiencies in the design of public educational and community facilities in tropical regions. Attia (2022) argued that many institutional buildings continue to rely heavily on mechanical cooling systems due to inadequate consideration of local climatic conditions during the design process. Likewise, Al-Tamimi (2022) observed that poor integration of passive design strategies often results in excessive energy consumption, thermal discomfort, and reduced environmental performance. In developing countries, these challenges are more pronounced because many public facilities are designed using generic design approaches that fail to respond effectively to local climatic realities. In Nigeria, the situation is particularly concerning. Ogunsote and Prucnal-Ogunsote (2019) noted that many public and educational buildings are characterized by poor building orientation, inadequate natural ventilation, insufficient solar protection, and inappropriate material selection. Similarly, Akande (2021) found that inadequate climate-responsive design practices have contributed significantly to rising energy demands and poor indoor environmental conditions in public infrastructure across West Africa. These shortcomings are especially problematic in cities such as Port Harcourt, where high temperatures, elevated humidity levels, and heavy rainfall create challenging environmental conditions for building users.

Research has also established a direct relationship between the quality of the built environment and user performance. According to World Green Building Council (2021), well-designed environments that provide adequate daylight, ventilation, and thermal comfort positively influence productivity, health, learning, and overall user satisfaction. Mahdavinejad et al. (2021) further argued that climate-responsive architectural strategies such as building orientation, passive cooling, shading systems, courtyard planning, and landscape integration significantly improve building performance and occupant well-being. These findings suggest that the effectiveness of Youth Development Centres is influenced not only by the programs they offer but also by the quality and responsiveness of their physical environments. Although extensive studies have been conducted on climate-responsive architecture and sustainable building design, most existing research has focused on residential, commercial, and general educational facilities (Attia, 2022; UNEP, 2023). Comparatively little attention has been given to Youth Development Centres, particularly within the Nigerian context where climatic challenges and youth development needs are rapidly evolving. Furthermore, existing studies rarely examine how climate-responsive design strategies specifically influence the planning and design of Youth Development Centres in tropical urban environments such as Port Harcourt.

This gap in knowledge highlights the need for a focused investigation into the relationship between climate-responsive design strategies and Youth Development Centre development. Therefore, this study seeks to address this gap by examining the impact of climate-responsive design strategies on the design of Youth Development Centres in Port Harcourt, Nigeria. The study aims to provide insights into how passive and environmentally responsive design approaches can improve sustainability, functionality, energy efficiency, and user experience within youth-oriented facilities.

➢ *Aim of the Study*

The aim of this study is to develop architectural design strategies that integrate climate-responsive design principles within youth development centres to optimize thermal comfort, reduce energy consumption, and support evolving learning, vocational, and social needs in Port Harcourt.

➢ *Objectives of the Study*

The specific objectives of the study are to:

- Identify key principles of passive and climate-responsive architecture applicable to the design of youth infrastructure in hot-humid climates.
- Evaluate the role of passive cooling, solar shading, and natural lighting systems in supporting diverse activities

such as ICT training, vocational workshops, and recreation.

- Develop architectural design guidelines that integrate building orientation, material thermal mass, and microclimatic planning for improved environmental functionality and user experience.
- Propose design recommendations that enhance spatial thermal performance, encourage continuous user engagement, and lower life-cycle operational energy dependencies.

➢ *Research Questions*

- What are the specific climate-responsive design principles required for youth development centre in hot-humid regions?
- How can passive ventilation and solar control strategies be effectively integrated into youth centre.
- What site planning, structural orientation, and spatial zoning choices are most effective for optimizing microclimates across mixed-use facilities (digital labs, workshops, sports courts) within a single development?
- What design strategies can be adopted to improve the climate responsiveness of Youth Development Centre in Port Harcourt?

II. LITERATURE REVIEW

➢ *Climate-Responsive Architecture*

Climate-responsive architecture has been widely discussed as a sustainable design approach that seeks to harmonize buildings with their surrounding climatic conditions. According to Givoni (2011), climate-responsive design involves the deliberate manipulation of building form, orientation, materials, and environmental systems to achieve thermal comfort while minimizing energy consumption. Similarly, Hyde (2018) argued that climate-responsive architecture is founded on the principle that buildings should respond directly to local environmental conditions rather than rely excessively on mechanical heating and cooling systems. Research by Yeang (2017) emphasized that climate-responsive buildings are designed to exploit natural resources such as sunlight, wind, and vegetation to improve environmental performance. In tropical climates, these principles become particularly important because high temperatures and humidity often contribute to thermal discomfort and increased energy demand. Emmanuel (2016) observed that poorly designed buildings in tropical regions frequently experience overheating and excessive dependence on artificial cooling systems. Likewise, Attia (2022) noted that climate-responsive strategies can significantly reduce operational energy consumption while improving indoor environmental quality.

Recent studies have demonstrated that climate-responsive architecture contributes to environmental sustainability, occupant well-being, and economic efficiency. According to the United Nations Environment Programme (UNEP, 2023), buildings account for a significant proportion of global energy consumption, making passive and climate-responsive solutions essential for sustainable development. Therefore, climate-responsive architecture has become an important design consideration for educational, community, and youth-oriented facilities.

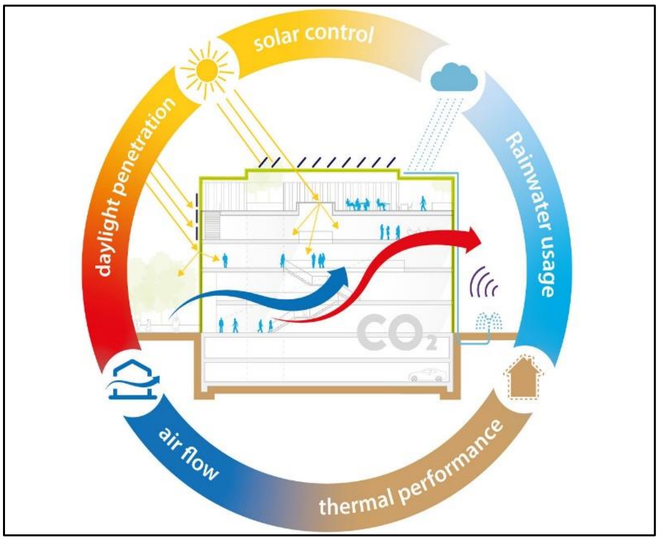

Fig 1 Climate Responsive Envelope Design, Aikaterini Doulkari, Paula Longato, Anke Rollenhagen, Nicholas Trowles
Source: https://www.burohappold.com/articles/climate-responsive-envelope-design/

➢ *Climate Characteristics of Port Harcourt*

The climatic conditions of a location significantly influence architectural design decisions. Port Harcourt is characterized by a tropical monsoon climate with consistently high temperatures, elevated humidity levels, and prolonged periods of rainfall throughout the year. According to the Nigerian Meteorological Agency (NiMet, 2023), average temperatures range between 24°C and 32°C, while annual rainfall frequently exceeds 2,000 mm. Ogunsote and Prucnal-Ogunsote (2019) argued that the climatic characteristics of southern Nigeria require building designs that prioritize ventilation, solar protection, and moisture control. Similarly, Emmanuel (2016) observed that hot-humid climates demand architectural solutions capable of maximizing airflow while minimizing heat gain. Inadequate responses to these climatic conditions often result in poor thermal performance, increased energy costs, and reduced occupant comfort.

The climatic challenges of Port Harcourt therefore present a strong case for the adoption of climate-responsive design strategies in Youth Development Centres. Such facilities must accommodate large numbers of users engaged in educational, vocational, and recreational activities, making environmental comfort a critical design consideration.

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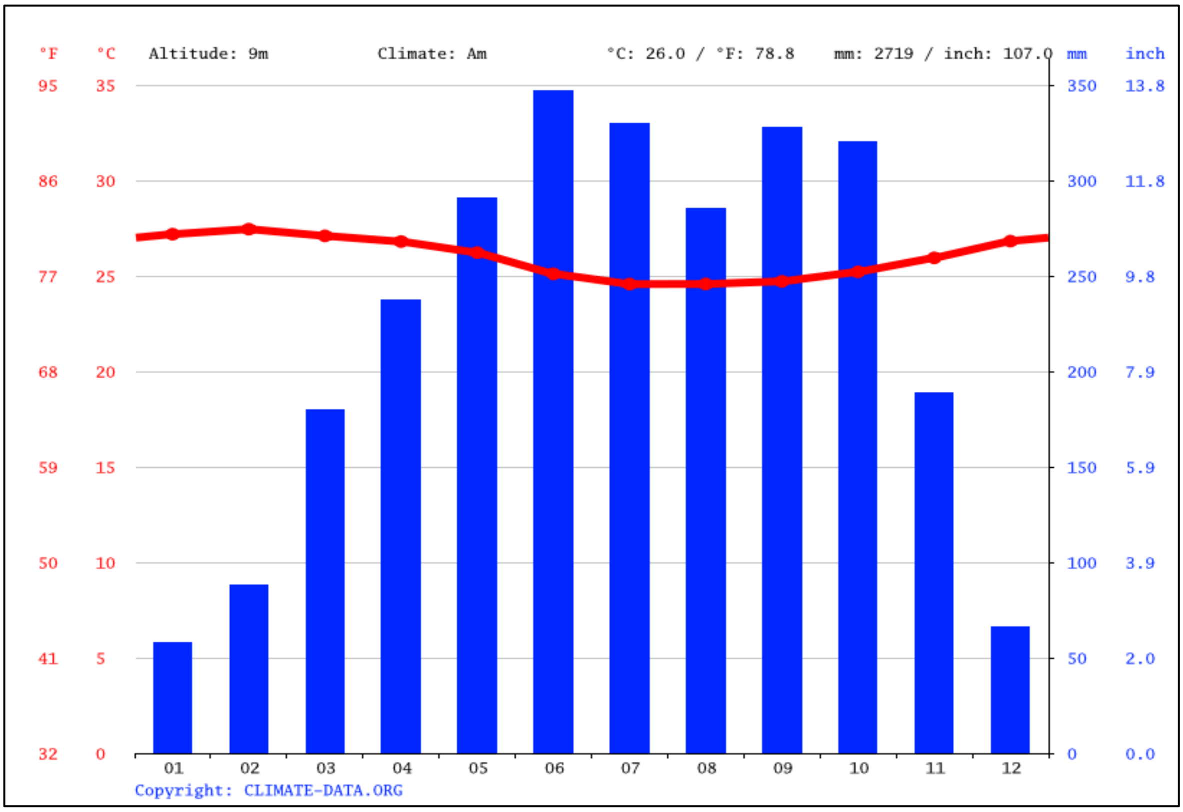

Fig 2 Rainfall chart of Port Harcourt
Source: https://en.climate-data.org/africa/nigeria/rivers/port-harcourt-528/

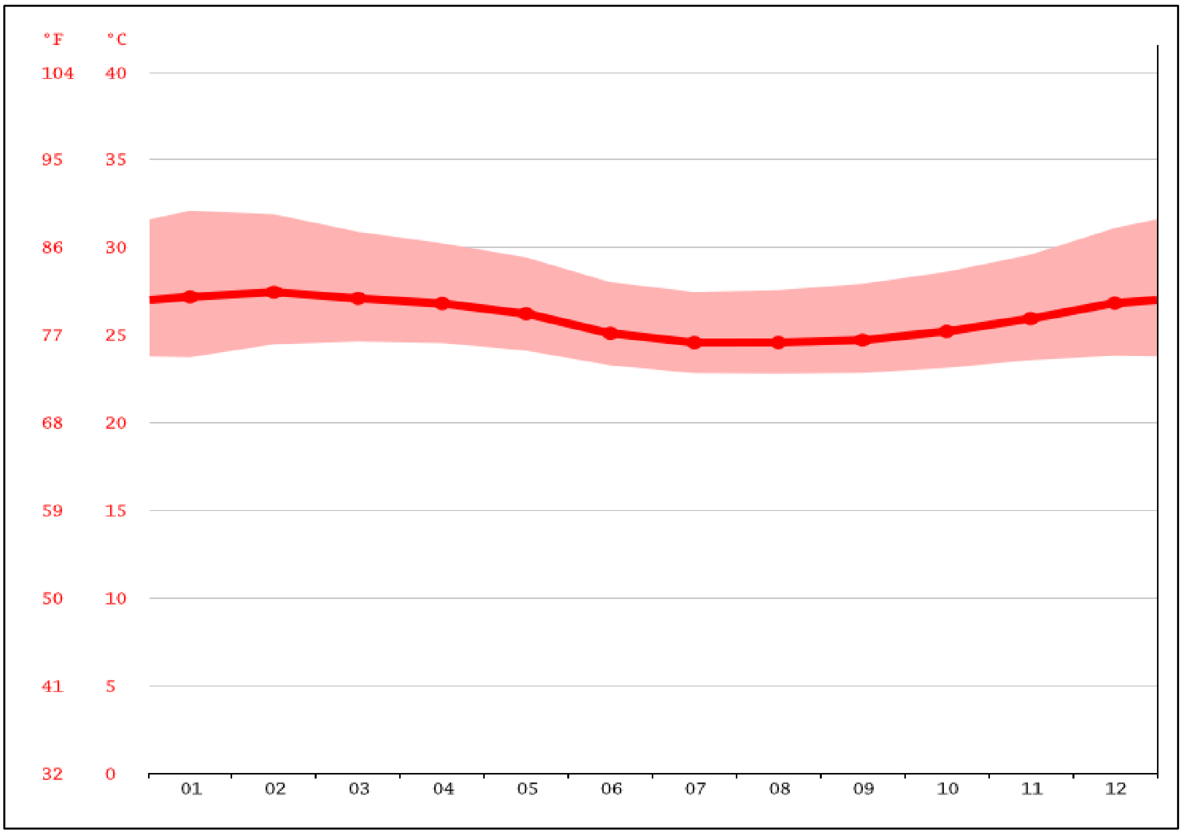

Fig 3 Average Temperature by month Port Harcourt
Source: https://en.climate-data.org/africa/nigeria/rivers/port-harcourt-528/

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	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	27.2 °C (80.9) °F	27.4 °C (81.4) °F	27.1 °C (80.8) °F	26.8 °C (80.2) °F	26.2 °C (79.2) °F	25.1 °C (77.2) °F	24.6 °C (76.2) °F	24.6 °C (76.2) °F	24.7 °C (76.5) °F	25.2 °C (77.4) °F	25.9 °C (78.7) °F	26.8 °C (80.3) °F
Min. Temperature °C (°F)	23.7 °C (74.7) °F	24.5 °C (76) °F	24.6 °C (76.3) °F	24.5 °C (76.2) °F	24.1 °C (75.4) °F	23.3 °C (73.9) °F	22.8 °C (73.1) °F	22.8 °C (73) °F	22.8 °C (73.1) °F	23.1 °C (73.6) °F	23.6 °C (74.4) °F	23.8 °C (74.9) °F
Max. Temperature °C (°F)	32.1 °C (89.8) °F	31.9 °C (89.4) °F	30.9 °C (87.6) °F	30.2 °C (86.4) °F	29.4 °C (85) °F	28 °C (82.4) °F	27.5 °C (81.4) °F	27.6 °C (81.6) °F	27.9 °C (82.3) °F	28.6 °C (83.5) °F	29.6 °C (85.3) °F	31.1 °C (88) °F
Precipitation / Rainfall mm (in)	58 (2)	88 (3)	180 (7)	237 (9)	291 (11)	347 (13)	330 (12)	285 (11)	328 (12)	320 (12)	189 (7)	66 (2)
Humidity(%)	75%	79%	84%	87%	89%	90%	89%	88%	90%	90%	87%	80%
Rainy days (d)	11	14	20	20	21	21	21	21	21	22	19	13
avg. Sun hours (hours)	8.0	7.6	7.3	7.1	6.3	4.9	4.5	4.7	4.6	5.5	6.3	7.8

Data: 1991 - 2021 Min. Temperature °C (°F), Max. Temperature °C (°F), Precipitation / Rainfall mm (in), Humidity, Rainy days. Data: 1999 - 2019: avg. Sun hours

Fig 4 Climate Table // Weather by Month Port Harcourt
Source: https://en.climate-data.org/africa/nigeria/rivers/port-harcourt-528/

- *Passive Design Strategies in Youth Development Centre*

Passive design strategies refer to architectural measures that improve building performance through natural environmental processes rather than mechanical systems. According to Givoni (2011), passive design seeks to optimize thermal comfort by utilizing natural ventilation, daylight, shading, and thermal mass. Similarly, Hyde (2018) identified passive design as one of the most effective approaches to achieving sustainable architecture in hot climates. Research has shown that passive design strategies are particularly beneficial in educational and community facilities. Barrett et al. (2015) found that environmental factors such as daylight, air quality, and thermal comfort significantly influence user productivity and learning outcomes. In Youth Development Centres, passive strategies can improve learning environments, enhance user well-being, and reduce operational costs.

Attia (2022) further argued that passive design solutions contribute to long-term sustainability by reducing dependence on energy-intensive mechanical systems. Consequently, passive strategies have become central to the design of contemporary youth facilities and community learning environments.

- *Building Orientation and Natural Ventilation*

Building orientation is one of the most fundamental principles of climate-responsive architecture. Olgyay (2015) emphasized that proper orientation enables buildings to minimize solar heat gain while maximizing natural airflow. Similarly, Yeang (2017) observed that building orientation directly affects energy performance, indoor comfort, and environmental quality. Natural ventilation complements orientation by facilitating continuous air movement through interior spaces. Givoni (2011) noted that cross ventilation and stack ventilation are among the most effective passive cooling strategies in tropical climates. According to Mahdavinejad et al. (2021), buildings designed to capture prevailing winds can achieve substantial reductions in indoor temperatures without mechanical cooling. For Youth Development Centres, natural ventilation creates healthier learning environments by improving indoor air quality and reducing thermal discomfort. The integration of orientation and ventilation strategies therefore contributes significantly to building performance and user satisfaction.

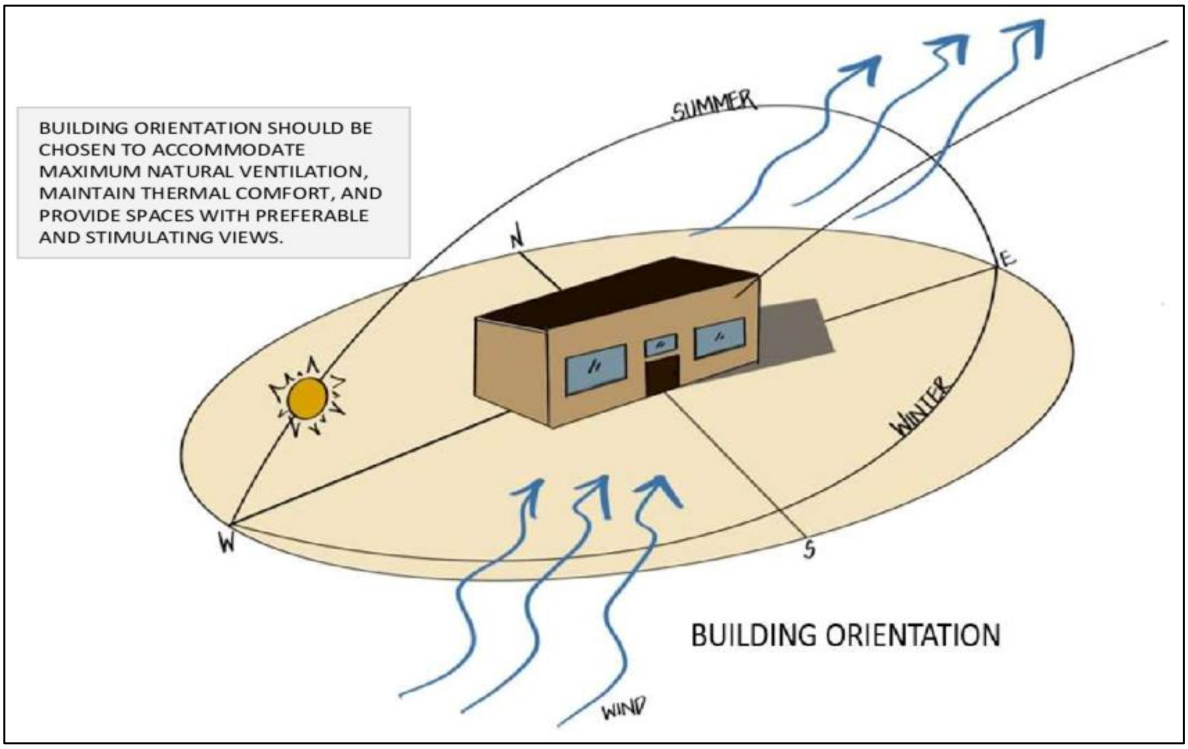

Fig 5 Cross-Ventilation Strategy and Building Orientation.
Source: https://www.researchgate.net/figure/Building-Orientation_fig1_373602293

➢ *Daylighting and Solar Shading*

Daylighting has been widely recognized as an essential component of sustainable building design. According to Barrett et al. (2015), access to natural light improves concentration, productivity, and psychological well-being in learning environments. Likewise, the International Energy Agency (2022) reported that effective daylighting can significantly reduce electricity consumption associated with artificial lighting.

However, excessive solar exposure may increase indoor temperatures and cause visual discomfort. To address this challenge, solar shading devices such as overhangs, louvers, fins, and screens are commonly employed. Hyde (2018) argued that shading devices are among the most effective passive design elements for controlling heat gain in tropical climates. Attia (2022) further emphasized that the integration of daylighting and shading strategies enhances both environmental performance and occupant comfort.

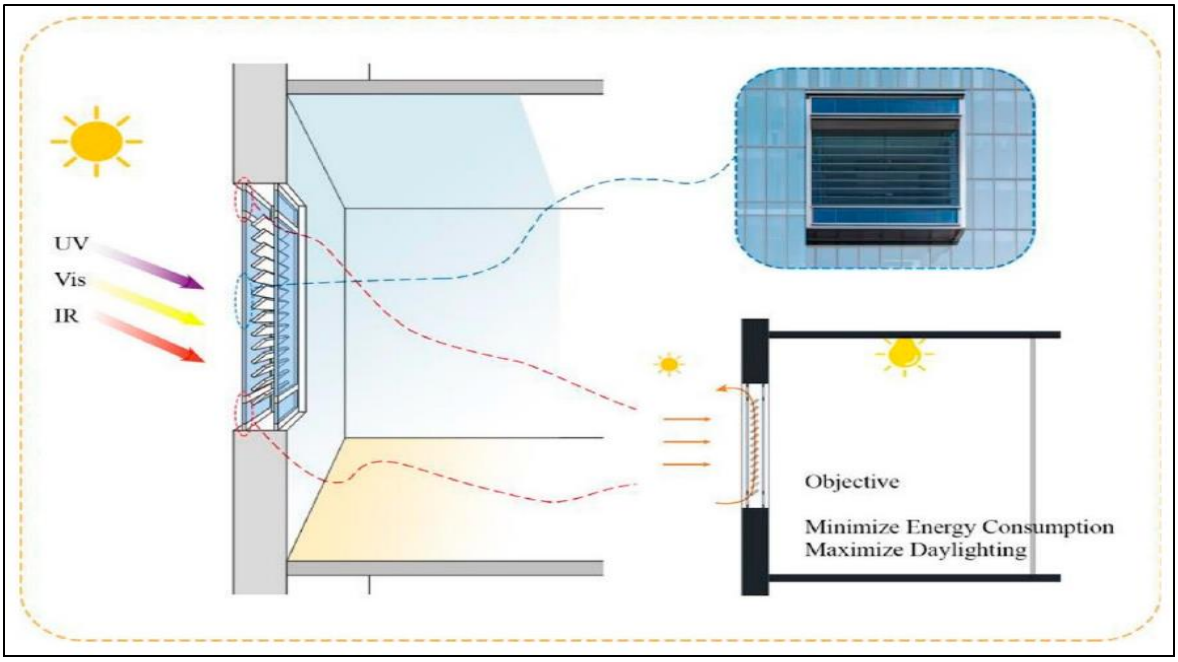

Fig 6 Solar Shading Devices and Daylighting Strategies.
Source: https://www.mdpi.com/2075-5309/15/7/1183

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➢ *Courtyard Design and Indoor-Outdoor Integration*

Courtyard design has long been recognized as a climate-responsive strategy in hot climates. According to Edwards (2014), courtyards improve natural ventilation, enhance daylight penetration, and create comfortable microclimates within buildings. Similarly, Yeang (2017) noted that courtyards function as passive cooling mechanisms by encouraging airflow and reducing heat accumulation. Recent studies have highlighted the social and functional benefits of courtyard spaces within educational and community facilities. Courtyards provide opportunities for recreation, interaction, and informal learning while strengthening the relationship between indoor and outdoor environments (Attia, 2022). In Youth Development Centres, courtyard spaces can support exhibitions, group activities, entrepreneurship programmes, and social events.

Fig 7 Courtyard-Based Spatial Layout for Community and Youth Facilities.
Source: https://www.promeai.pro/design-ideas/architecture/cultural-architecture/youth-center/602721686211461

➢ *Landscape Integration and Environmental Sustainability*

Landscape design plays a vital role in climate-responsive architecture by improving environmental quality and mitigating adverse climatic conditions. According to World Green Building Council (2021), vegetation reduces ambient temperatures, improves air quality, and contributes to user well-being. Likewise, Hyde (2018) argued that landscape elements such as trees and water features enhance microclimatic conditions around buildings. Research by Yeang (2017) demonstrated that integrating vegetation into architectural design contributes to environmental sustainability and energy efficiency. In educational and community facilities, landscaped outdoor spaces also encourage social interaction and recreational activities.

➢ *Impact of Climate-Responsive Design on Youth Development Centres*

Several studies have established a strong relationship between climate-responsive design and building performance. Attia (2022) found that passive environmental strategies improve thermal comfort, reduce operational energy costs, and enhance occupant satisfaction. Similarly, Mahdavinejad et al. (2021) reported that climate-responsive buildings outperform conventional buildings in terms of

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environmental efficiency and user comfort. Within Youth Development Centres, these benefits extend beyond environmental performance to include improved learning experiences, enhanced creativity, and increased social interaction. UNEP (2023) emphasized that sustainable building environments contribute positively to educational outcomes and community development. Consequently, the integration of climate-responsive design principles is essential for creating functional, sustainable, and user-centered Youth Development Centres in Port Harcourt.

III. METHODOLOGY

This study adopted a qualitative research approach to investigate the impact of climate responsive design strategies on the design of Youth Development Centre in Port Harcourt. This approach enabled an in depth exploration of existing literature, design principles, and architectural practices related to climate responsive architecture and youth facility design. Data for the study were obtained from secondary sources, including peer reviewed journal articles, conference proceedings, books, institutional reports, and professional publications related to climate responsive architecture, passive design strategies, sustainable building design, and youth development facilities. The reviewed literature focused on recent studies published between 2016 and 2026 to ensure relevance to current architectural discourse and contemporary environmental challenges. A case study review method was also employed to examine selected examples of climate responsive educational, community, and youth-oriented facilities. The selected case studies were analyzed based on key climate responsive design indicators, including building orientation, natural ventilation, daylighting strategies, solar shading systems, landscape integration, courtyard planning, and passive cooling techniques. The collected information was subjected to content analysis, where recurring themes, design strategies, and architectural responses were identified and synthesized. Findings from the literature and case studies were subsequently evaluated to determine their implications for the planning and design of Youth Development Centre within the climatic context of Port Harcourt, Nigeria.

IV. FINDINGS AND DISCUSSION

The review of literature and case studies revealed that climate responsive design strategies significantly influence the overall performance, sustainability, and functionality of Youth Development Centre. The findings indicate that buildings designed in response to local climatic conditions provide healthier, more efficient, and more adaptable environments for learning, skill acquisition, recreation, and entrepreneurship.

➢ *Building Orientation and Environmental Performance*

One of the major findings of the study is the importance of building orientation in reducing solar heat gain and improving natural ventilation. Buildings oriented to take advantage of prevailing wind directions and minimize exposure to direct solar radiation generally perform better in tropical climates. Recent studies have demonstrated that proper orientation can significantly reduce indoor temperatures and lower cooling energy demands (Attia, 2022). For Youth Development Centre in Port Harcourt, strategic orientation can improve environmental conditions within classrooms, workshops, digital laboratories, and recreational spaces. Orientation also contributes to effective daylight penetration while minimizing glare and overheating.

➢ *Natural Ventilation and Indoor Air Quality*

The findings reveal that natural ventilation remains one of the most effective climate responsive strategies in tropical architecture. Cross ventilation, stack ventilation, and the use of operable openings contribute to improved air circulation and thermal comfort. Buildings that effectively utilize prevailing wind patterns achieve better indoor environmental quality while reducing dependence on mechanical cooling systems (UNEP, 2023). In Youth Development Centre, naturally ventilated environments support learning and vocational training activities by creating comfortable indoor conditions that enhance concentration, productivity, and user satisfaction.

➢ *Daylighting and Energy Efficiency*

The study found that daylighting strategies contribute significantly to energy efficiency and spatial quality. The use of windows, clearstories, skylights, and light shelves increases access to natural light, reducing dependence on artificial lighting during daytime hours. Research indicates that naturally lit environments positively influence learning outcomes, visual comfort, and occupant wellbeing (International Energy Agency, 2022). Within Youth Development Centre, effective daylighting improves the functionality of classrooms, studios, ICT laboratories, innovation hubs, and collaborative learning spaces while reducing operational costs associated with electricity consumption.

➢ *Solar Shading and Thermal Control*

The findings show that solar shading devices play a critical role in mitigating excessive heat gain in tropical environments. Architectural elements such as overhangs, louvers, screens, canopies, and vegetation effectively reduce solar radiation entering buildings while maintaining daylight access and visual connectivity. Studies have shown that properly designed shading systems improve thermal performance and reduce cooling loads in educational and community facilities (Mahdavinejad et al., 2021). For Youth Development Centre in Port Harcourt, shading strategies are particularly important due to the region's high solar intensity and humid climatic conditions.

➢ *Courtyard Planning and Indoor-Outdoor Integration*

The review revealed that courtyards serve as effective environmental and social spaces within climate responsive buildings. Courtyards enhance natural ventilation, facilitate daylight penetration, and create opportunities for social interaction and informal learning. In tropical climates, courtyard planning contributes to passive cooling and microclimate regulation. For Youth Development Centre, courtyards can function as multifunctional spaces that support recreation, exhibitions, collaboration, and community engagement while simultaneously improving environmental

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performance. The integration of indoor and outdoor spaces also promotes flexibility and adaptability within the facility.

➢ *Landscape Integration and Microclimate Improvement*

Another significant finding is the contribution of landscape elements to climate responsive design. Trees, vegetation, green spaces, and water features improve microclimatic conditions by providing shade, reducing surface temperatures, and enhancing outdoor comfort. Landscape integration also improves the visual quality and environmental sustainability of youth facilities. The findings indicate that landscape design should not be treated as an afterthought but as an integral component of climate responsive architectural planning. In Port Harcourt, where high temperatures and humidity are prevalent, strategically designed landscapes can significantly enhance the usability of outdoor spaces.

➢ *Implications for Youth Development Centre Design*

The overall findings demonstrate that climate responsive design strategies contribute to sustainable, functional, and user-centered Youth Development Centres. The integration of passive environmental strategies reduces energy consumption, lowers operational costs, and improves environmental quality. Furthermore, climate responsive architecture supports flexibility, adaptability, and long-term building performance. The study suggests that future Youth Development Centres in Port Harcourt should prioritize climate responsive principles from the earliest stages of planning and design. Such an approach will ensure that facilities remain environmentally sustainable while effectively supporting youth development activities.

V. CONCLUSION

This study examined the impact of climate responsive design strategies on the design of Youth Development Centre in Port Harcourt. The findings reveal that climate responsive architecture plays a crucial role in improving building performance, environmental sustainability, and user experience. Strategies such as proper building orientation, natural ventilation, daylight optimization, solar shading, courtyard planning, and landscape integration contribute significantly to creating efficient and comfortable learning environments.

The study further establishes that climate responsive design reduces dependence on mechanical environmental control systems, lowers operational costs, and promotes sustainable development. Given the climatic characteristics of Port Harcourt, integrating passive design strategies into Youth Development Centres is essential for achieving long term functionality and resilience. Ultimately, climate responsive architecture provides an effective framework for designing Youth Development Centre that are environmentally responsible, economically viable, and capable of supporting the diverse educational, vocational, recreational, and entrepreneurial activities of young people.

RECOMMENDATIONS

➢ *Based on the Findings of this Study, the Following Recommendations are Proposed:*

- Architects should integrate climate responsive design principles during the early stages of planning and design of Youth Development Centre.
- Building orientation should be carefully considered to optimize natural ventilation and reduce solar heat gain.
- Passive ventilation strategies should be prioritized to minimize dependence on mechanical cooling systems.
- Courtyard planning and indoor-outdoor integration should be incorporated to improve environmental performance and social interaction.
- Effective solar shading devices should be utilized to enhance thermal performance and reduce cooling loads.
- Landscape elements should be strategically integrated to improve microclimatic conditions and environmental quality.
- Government agencies and development organizations should promote climate responsive design standards for youth oriented public facilities.
- Further research should investigate the quantitative performance of climate-responsive design strategies in youth facilities located within tropical climates.

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