

**THERMAL PERFORMANCE OF BUILDING ENVELOPES
OF PUBLIC PRIMARY SCHOOL CLASSROOMS
IN
LAGOS METROPOLIS, NIGERIA**

BY

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NOVEMBER, 2017

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SCHOOL OF POSTGRADUATE STUDIES
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CERTIFICATION

This is to certify that the Thesis:

**THERMAL PERFORMANCE OF BUILDING ENVELOPES OF PUBLIC
PRIMARY SCHOOL CLASSROOMS IN LAGOS METROPOLIS, NIGERIA**

Submitted to the
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For the award of the degree of
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is a record of original research carried out

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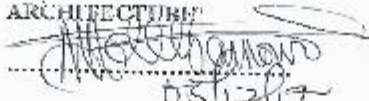
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We hereby certify That the Work in this Thesis Titled: 'Thermal Performance of Building Envelopes of Public Primary School Classrooms in Lagos Metropolis, Nigeria' was carried out under our supervision and that it is the original work of the researcher, OGINNI OLAIDE ADEYEMI.

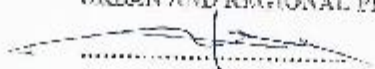
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DEDICATION

I dedicate this thesis to the Lord God Almighty, *my rock, my fortress, my high tower and shield*, for granting me the fortitude and tenacity to carry out this research.

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LIST OF ABBREVIATIONS AND ACRONYMS

ASHRAE- American Society of Heating, Refrigerating and Air-conditioning Engineers

PMV- Predicted Mean Vote

POE- Post Occupancy Evaluation

TPV- Thermal Performance Vote

TSV- Thermal Sensation Vote\

BPE- Building Performance Evaluation

CLO- Clothing

HVAC- Heating, Ventilation and Air Conditioning

MRT- Mean Radiant Temperature

IES- Integrated Environmental Solutions

BIM- Building Information Modeling

NV- Natural Ventilation

MV- Mixed-mode Ventilation

ABSTRACT

Building performance in terms of energy, thermal and environmental management are front burner issues in most parts of the world, presently. The building envelope and its constituent materials play a significant role in determining the indoor thermal comfort within a space. Building thermal performance is ultimately a combination of several factors, inclusive of the impact of the building envelope, occupancy levels, and internal equipment. Limited research has been carried out on school buildings in Africa, especially for children below the age of 11. The aim of this research is to assess the building envelope and thermal performance of public school classrooms in Lagos Metropolis against readily established standards. Objectives of the study are identification of the characteristics of primary school building envelopes in Lagos Metropolis, evaluation of the thermal performances of primary school classrooms, evaluation of the relationship between the building envelopes and the thermal performance, the assessment of the impact of thermal performance on pupils' comfort and development of a model explaining relationship between the building envelope and the pupils' comfort. Using a two-stage sampling method, questionnaires were distributed to stakeholders in schools selected from the six educational districts; using the proportionate stratified random sampling technique. Subjective and objective measurements were carried out according to class II field experiment method and in consonance with ASHRAE's (American Society of Heating, Refrigerating and Air-Conditioning, Engineers) stipulated standards. The results showed that three variables - air temperature, humidity levels, and class density accounted for about 52% of the variability in the Thermal Preference Vote of the respondents. Findings also showed neutral temperature at 27⁰C, which is over and above the lower boundary of 24⁰C recommended by ASHRAE. This is owing to adaptations in the tropics. The 'U' shaped layout of classrooms was found to be most preferable for Lagos Metropolis, as it was found to have the greatest stability, self-shading, compactness, and thermal efficiency of the four classroom layouts investigated. Recommendations were made for future provisions of classroom designs to be tailored towards enhancement of activities at the hottest periods of the day and year, and no single design template should be adopted for use on various sites.

KEYWORDS: Thermal Performance, Building Envelope, Thermal Comfort, Public Primary Schools, Lagos Metropolis.