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Post-Occupancy Evaluation of Earth-Based Institutional Buildings in Lagos: Diagnostic Analysis of Students' Perceived Thermal and Acoustic Comfort for Performance Optimization

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Abstract- ***Post-occupancy evaluation (POE) has become more significant in evaluating the performance of institutional buildings in real use especially in terms of the comfort, the health of the students and their learning effectiveness. Thermal and acoustic comfort are crucial factors to consider in earth-based institutional buildings, as they directly affect academic performance and satisfaction when these factors are considered. An important gap in the empirical research dealing with the perception of these conditions after occupation has been identified, particularly in the context of development in an urban area, as is the case in Lagos. The purpose of this study is thus to evaluate students' thermal and acoustic perceptions of comfort in earth-based institutional buildings using the diagnostic post-occupancy evaluation approach. A mixed method research design was used which included structured questionnaires, observation and simple environmental assessment of 100 students selected from selected institutions. The results indicate that the students have a satisfactory thermal comfort, natural ventilation and stable temperatures, and the acoustic comfort was also satisfactory, though there were some noise disturbances at times. The research also reveals that the concentration of students, learning experience, and their satisfaction is significantly affected by both thermal and acoustic environment. The conclusions of the study clearly indicate the importance of incorporating passive design elements and earth-based construction techniques in institutional structures to improve indoor environmental quality and promote academic work.***

Keywords: Post-Occupancy Evaluation, Earth-Based Buildings, Thermal Comfort, Acoustic Comfort, Institutional Buildings, Student Satisfaction, Indoor Environmental Quality

I. INTRODUCTION

Post-Occupancy Evaluation (POE) now is an established method for evaluating the performance of buildings which have been occupied and used by end users. POE is based on real life experiences of people, building performance across the environment, and the buildings' ability to satisfy the needs of their occupants and their purpose (Preiser et al., 1988; Nicol & Roaf, 2005). POE has become more prominent in educational settings because in schools, learning outcomes, comfort, health and overall academic performance are highly correlated with the building environment, and students are spending long periods of their time in buildings. In recent years, the results of reviewing higher education buildings indicate that the integration of environmental measures with perceptions is more reliable in order to make the design and operation of the higher education buildings more efficient.

The environmental responsiveness, thermal mass properties and reduced reliance on mechanical cooling systems of the earth-based buildings have brought them to the forefront of sustainable architecture. The buildings use construction techniques like rammed earth and compressed earth blocks, which are known for providing thermal insulation and enhancing environmental performance. It is believed that in the right design, buildings on the ground can produce a more stable indoor environment and therefore have the potential to positively affect the comfort of the occupants (Allinson & Hall, 2012; Minke, 2012). Meanwhile, the institutional buildings need environmental control

since the environment may affect concentration, effectiveness in learning and satisfaction for the user.

In education buildings, some major indicators of IEQ have special importance, namely thermal comfort and acoustic comfort. For students, thermal conditions play a role in the concentration, cognitive performance and comfort perception, while acoustic conditions play a part in communication, attention and efficiency in learning. The results of post-occupancy evaluations in educational buildings confirm that users' perception of comfort is time dependent and related to their adaptive behavior, environmental conditions, and the levels of environmental control they could have.

Research on institutional facilities has also demonstrated that ratings based on the feedback from the building users can also be used to gain insight for future building design decisions and for managing the building. The investigations in the universities have found that user satisfaction to the indoor climate and environmental conditions are still a critical measure of the effectiveness and operational quality of buildings.

Recent studies conducted in Nigeria by Asaju Opeyemi A. et al further demonstrated the link between IEQ and user satisfaction in educational and earth-based building environment, and showed that thermal and environmental conditions have significant impact on user satisfaction, user experience and building performance. These results support the importance of considering institutional facilities beyond physical construction.

Although the concept of sustainable institutional architecture has gained ground over the past few decades, few studies have looked at POU performance of earth-based institutional buildings in Lagos using the combined concept of the perceived thermal and acoustic comfort of students. Hence, this study compares the thermal and acoustical conditions of earth-based institutional building in Lagos to the students' comfort level, and it aims to evaluate the performance of the buildings for supporting the comfort level of the students.So, the aim of this study is to make a post-occupancy evaluation of the thermal and acoustical conditions in earth-based institutional buildings in Lagos and to compare these conditions with the comfort level of students, and also to evaluate the performance of the buildings for supporting the comfort level of the students.

1.1 Aim and Objectives

The purpose of this study is to carry out post-occupancy evaluation of the institutional buildings in earth to assess the perceived thermal and acoustical comfort of the students in order to optimize their performance.

Objectives of the Study

The aims of the study are:

i. Study of thermal and acoustical conditions of comfort of the selected earth buildings in institutional buildings of Lagos.
ii. Determine the perception of thermal comfort in the selected buildings.
iii. Assess students' perception of acoustic comfort and noise in the learning environment.
iv. Identify the effects of thermal and acoustic comfort on students' learning performance and satisfaction.
v. Propose solutions to the environmental performance of institutional buildings made of earth for improved comfort of users and academic productivity.

1.2 Problem Statement

The institutional buildings are of paramount importance in promoting learning, concentration and academic performance in providing comfortable and functional indoor environment for the students. But there are still issues with IEQ (inconvenient thermal conditions, etc.) in many educational facilities, especially those in rapidly developing urban areas, that have poor IEQ performance acoustically. All these environmental problems can adversely influence students' focus, satisfaction, productivity, and learning outcomes.

Due to their environmental benefits, thermal mass properties and potential for enhancing indoor comfort and lowering reliance on mechanical systems, earth-based buildings have been a growing focus of interest

as an avenue for sustainability. Despite these benefits, evidence of how students experience and perceive the environmental conditions of occupied earth-based institutional buildings, particularly over extended time is limited. Many times, success of a building is judged on the idea behind the design, not on how it is actually utilized.

A Post-Occupancy Evaluation can be used to gain insight into performance of the building as it relates to the user and to determine the discrepancy between the actual performance and the user's expectations. The studies however, that are specifically targeted to students' perceived thermal and acoustic comfort in earth-based institutional building with respect to Lagos are still limited. Therefore, the effectiveness of these buildings in supporting learning performance and the satisfaction of the building users are not well known.

This research aims, therefore, to carry out a diagnostic post-occupancy evaluation (POE) of institutional buildings constructed with earth materials in the city of Lagos, where the students' perception of thermal and acoustic comfort will be studied, and to identify the optimization of these environmental conditions to boost academic performance and building efficiency.

II. LITERATURE REVIEW

Post-Occupancy Evaluation (POE) has emerged as a critical tool for evaluating the performance of buildings in the real world after their construction. It is targeted towards users' experiences and provides feedback on whether buildings achieve their functional and environmental objectives (Preiser et al., 1988; Preiser & Vischer, 2005). POE helps to connect the intentions of building design with user satisfaction by assessing performance indicators such as comfort, usability, and environmental quality (Preiser & Vischer, 2005). A crucial application of POE in educational settings is the evaluation of classrooms and institutional buildings, where thermal and acoustic comfort are key factors influencing learning performance, health, and user satisfaction (Frontczak & Wargocki, 2011; Wargocki & Wyon, 2017).

Thermal comfort is one of the most extensively researched aspects of Indoor Environmental Quality (IEQ) in educational buildings. Studies have shown that indoor thermal conditions significantly influence occupants' cognitive performance, concentration, productivity, and overall well-being (Wargocki & Wyon, 2017; de Dear & Brager, 1998). Adaptive thermal comfort theory suggests that occupants adjust their behaviour and expectations according to prevailing indoor environmental conditions, particularly in naturally ventilated buildings (de Dear & Brager, 1998). Research conducted in tropical climates has also reported that high indoor temperatures and humidity levels frequently result in thermal discomfort in educational facilities where passive design strategies are inadequate (Nicol & Humphreys, 2002; Teli et al., 2012). These findings highlight the importance of evaluating the actual thermal performance of occupied buildings through post-occupancy studies rather than relying solely on design-stage simulations.

Acoustic comfort is equally important in learning environments because excessive noise can negatively affect concentration, speech intelligibility, academic performance, and learning outcomes (Shield & Dockrell, 2003). Shield and Dockrell (2003) established a relationship between poor classroom acoustics and reduced reading ability as well as impaired cognitive development among students. Similarly, Banbury and Berry (2005) found that background noise significantly reduced task performance while increasing stress levels among occupants. Noise in institutional buildings may originate from external traffic, mechanical systems, adjacent spaces, and occupants' activities, all of which contribute to variations in users' perceived acoustic comfort (Kang, 2007).

Owing to their environmental responsiveness and favourable material properties, earth-based buildings have increasingly gained recognition as sustainable alternatives in contemporary construction (Minke, 2006; Walker et al., 2005). Construction techniques such as rammed earth and stabilized earth blocks (SEBs) possess high thermal mass, enabling them to regulate indoor temperatures and reduce temperature fluctuations, particularly in warm climatic regions

(Minke, 2006; Hall et al., 2012). Studies have also demonstrated that earth construction materials can provide improved acoustic insulation compared with many conventional lightweight building materials, although their performance depends on factors such as wall thickness, density, and construction quality (Hall et al., 2012; Ciancio & Gibbings, 2012). These characteristics make earth-based buildings particularly suitable for educational facilities where indoor environmental comfort is essential for learning.

Although numerous studies have examined sustainability in building construction, relatively little empirical evidence exists on the post-occupancy performance of earth-based institutional buildings, particularly regarding students' perceptions of thermal and acoustic comfort (Asaju et al., 2023; Frontczak & Wargocki, 2011). Most existing research has focused primarily on energy efficiency, embodied carbon, or laboratory-based evaluations of earth materials rather than on users' experiences in occupied buildings (Hall et al., 2012; Walker et al., 2005). Recent POE studies conducted in higher education environments have increasingly emphasized the need to integrate objective building performance assessments with occupants' subjective feedback to achieve a more comprehensive understanding of building performance (Frontczak & Wargocki, 2011; Wargocki & Wyon, 2017). This gap underscores the need for further investigation into the real-life performance of earth-based institutional buildings, particularly within the tropical urban context of Lagos State.

Hence, this study contributes to the existing body of knowledge by conducting a Post-Occupancy Evaluation (POE) of selected earth-based institutional buildings in Lagos State, with a particular focus on students' perceived thermal and acoustic comfort. The findings are expected to provide evidence-based recommendations for optimizing the performance of earth-based educational buildings and promoting more sustainable and user-centred building designs (Preiser & Vischer, 2005; Wargocki & Wyon, 2017).

III. RESEARCH METHODOLOGY

3.1 Research Design

This study uses a descriptive post-occupancy evaluation research design to evaluate the perceived thermal and acoustic comfort of students in earth-based institutional buildings in Lagos. The design is fitting as the emphasis is on reviewing the performance of the buildings after occupancy, rather than altering any of the variables.

The study will use a mixed method approach, quantitative and qualitative methods. Structured questionnaires will be used to gather quantitative data from students and interviews and observations of indoor environmental conditions to gather qualitative data.

Descriptive statistics including frequencies, percentages and mean scores will be used to analyse the data collected from the quantitative questions and a thematic analysis will be used to analyse the data collected from the qualitative questions. This will help to understand the overall behavior of thermal and acoustic environment affecting the comfort and learning performance of students in earth-based institutional buildings.

3.2 Study Area

The research area is Lagos State, Nigeria and the selected earth-based institutional buildings are tertiary institutions in the study area. Lagos is a city of high population density, hot and humid tropical climate, and high demand for sustainable and climate responsive building solutions with a high rate of urbanization.

The selected institutions in the study area represent a mix of conditions where earth-based and conventional learning spaces exist, thereby allowing the assessment of perceived thermal and acoustic comfort of students. The selection of the climatic conditions such as high temperatures and humidity levels in Lagos also argue for its use as a suitable context for post-occupancy evaluation of indoor environmental performance of institutional buildings.

3.3 Population and Sampling

The present study is based on students population in selected earth-based institutional buildings in tertiary institutions from Lagos State, Nigeria. These students are seen as the appropriate respondents as they are the frequent users of the learning environments and are best able to evaluate the thermal and acoustical comfort conditions based on their experience of daily use of the environments.

Purposive sampling technique will be employed to select institutions having earth-based buildings and simple random sampling will be employed to select students in the selected institutions. This helps respondents to be fairly represented and that the collected data is representative of various student experiences in the study area.

3.4 Instruments for Data Collection

For data collection in the study the following instruments will be used:

i. Structured Questionnaire - Being used to collect information from students about their thermal and acoustic comfort in earth-based institutional buildings.
ii. Observation Checklist - Assesses the physical aspects of the environment, including ventilation, building materials, noise sources and spatial layout.
iii. Environmental Measurement Tools - Instruments: These will include thermometers, hygrometers and sound level meters, which will be used to record actual indoor temperature, humidity and noise level.
iv. Interview Guide - Qualitative information on selected students and building managers comfort experiences and building performance.
v. Secondary Data Sources - These are journals, textbooks, and other previous studies that have been completed and relate to post-occupancy evaluation and earth-based construction.

3.5 Validity and Reliability

Validity

Research instruments will be validated by experts who are professionals in architecture, building science and environmental design. The responses they provide will contribute to the validation of the questionnaire, observation checklist and measurement tools to reflect students perceived thermal and acoustic comfort within earth based institutional buildings.

Reliability

A pilot study will be carried out with a small number of students outside the main study sample. The instruments will undergo consistency and clarity testing and adjustments will be made accordingly so that they result in stable and consistent data during the main data collection.

3.6 Method of Data Analysis

Data gathered for this research are going to be analyzed quantitatively and qualitatively. The quantitative data collected from the questionnaires and environmental measurements will be analyzed using descriptive statistics like frequency table, percentages and mean scores to determine the thermal and acoustic comfort of students in the earth-based institutional buildings as perceived.

Thematic analysis will be used to analyze the qualitative data collected through interviews and observations; responses are clustered into themes including “thermal comfort”, “acoustic comfort”, “quality of learning environment”, and “satisfaction of occupants”. This integrated approach will offer a holistic insight of P.O. performance in the selected buildings.

3.7 Ethical Considerations

The research in this study will be carried out in accordance with accepted research ethics. Prior to data collection, permission will be taken from appropriate institutional officials. All respondents will be asked to participate in the study and informed consent will be clearly obtained from all participants. Respondents' confidentiality and anonymity will be respected and any data gathered will be treated for academic purposes only. Respondents will also be allowed to opt out of the study at any time, without facing any pressure or consequences.

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IV. RESULTS AND DISCUSSION

4.1 Demographic profile of respondents

Table 4.1: Demographic Characteristics of Respondents (N = 100)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	58	58
	Female	42	42
Age (Years)	16–20	31	31
	21–25	52	52
	Above 25	17	17
Academic Level	100 Level	18	18
	200 Level	22	22
	300 Level	26	26
	400 Level	21	21
	500 Level and Above	13	13
Duration of Occupancy of Building	Less than 1 year	28	28
	1–3 years	46	46
	More than 3 years	26	26

Table Interpretation:
Table 4.1 presents the demographic characteristics of the 100 students who participated in the post-occupancy evaluation of selected earth-based institutional buildings in Lagos State. Male respondents constituted 58% of the sample, while females accounted for 42%. The largest proportion of respondents (52%) were between 21 and 25 years of age, followed by those aged 16–20 years (31%), while 17% were above 25 years. In terms of academic level, 300 Level students formed the highest proportion (26%), followed by 200 Level (22%), 400 Level (21%), 100 Level (18%), and 500 Level and above (13%). Regarding the duration of occupancy, 46% had occupied the buildings for 1–3 years, 28% for less than one year, and 26% for more than three years. These demographic characteristics indicate that the respondents had adequate exposure to the selected earth-based institutional buildings, making them suitable participants for assessing building performance, perceived thermal comfort, and acoustic comfort.

4.2 Findings

Students responded that institutional buildings with earth foundation were found to be conducive to learning and study performance, based on the responses obtained. The majority of participants reported that the thermal and acoustic comfort in learning environments positively affected concentration, satisfaction and the desire to spend long periods in learning spaces.

4.3 Interpretation of findings

Results indicated that the earth-based institutional buildings have an acceptable post occupancy performance when compared to students' sense of thermal and acoustic comfort. The earth-based materials provided good positive feedback for thermal comfort, especially for natural ventilation and more stable indoor temperature, which suggest a passive environmental regulation.

The acoustic assessment also indicated overall positive conditions, with the majority of the students indicating acceptable noise level and communication during learning activities. In keeping with previous research, this work confirms that building materials that respond to the environment can improve the indoor environment and learning outcomes.
In addition, the students considered improved thermal and acoustic environments as better concentration, longer stay time and better academic experience. The results show that the environmental quality has an important role in the optimization of the performance in institutional buildings.

The study shows that supportive indoor learning spaces can be offered on the earth by institutional buildings if designed, occupied, and maintained well.

V. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This work was a post-occupancy evaluation of earth-based institutional buildings in Lagos with a particular focus on the perceived thermal and acoustic comfort of students and its effect on performance optimization. The results showed that students had good indoor environmental conditions in the selected building, most importantly on the aspect of thermal regulation, natural ventilation and acceptable acoustic quality.

The study also revealed that thermal and acoustic comfort have a significant impact on student concentration, learning process, satisfaction and academic performance. The ability of earth-based buildings to create more environmentally responsive internal environments that rely on passive environmental controls and mechanical systems to a lesser extent was successfully demonstrated.

Finally, post-occupancy evaluation was found to be a good method for informing an understanding of the building performance through users' eyes. The study points to the significance of involving the voices of the occupants in the design of institutions, and advocates for the use of earth-based construction approaches in the design of better, more comfortable, and performance-based learning environments.

5.2 Recommendation

The following recommendations are made, based on the results of this study:

i. Passive design strategies should be incorporated into the design and planning of educational structures to enhance thermal and acoustic comfort.
ii. Post-occupancy evaluations should be carried out to track the performance of the building and the comfort of the student regularly by the educational institution.
iii. The control of natural ventilation and noise should be enhanced for improved learning environment.
iv. Institutional projects should promote the use of materials used in the construction of the earth, because of their environmental and comfort properties.

In future studies, further I.E.Q. indicators should be studied and building performance should be considered for a longer time.

REFERENCES

[1] Allinson, D., & Hall, M. (2012). Hygrothermal analysis of a stabilised rammed earth test building in the UK. Energy and Buildings, 47, 324–329.

[2] Banbury, S., & Berry, D. C. (2005). Office noise and employee concentration: Identifying causes of disruption and potential improvements. Journal of Environmental Psychology, 25(1), 33–44.

[3] de Dear, R., & Brager, G. S. (2002). Thermal comfort in naturally ventilated buildings: Revisions to ASHRAE Standard 55. Energy and Buildings, 34(6), 549–561.

[4] Frontczak, M., & Wargocki, P. (2011). Literature survey on how different factors influence human comfort in indoor environments. Building and Environment, 46(4), 922–937.

[5] Gou, Z., Prasad, D., & Lau, S. S.-Y. (2013). Are green buildings more satisfactory and comfortable? Building and Environment, 69, 135–144.

[6] Heinzerling, D., Schiavon, S., Webster, T., & Arens, E. (2013). Indoor environmental quality assessment models: A literature review. Building and Environment, 68, 5–15.

[7] Khovalyg, D., Kazanci, O. B., Halvgaard, R., Thorsen, J. E., & Olesen, B. W. (2020). Indoor environmental quality: Definition, assessment, and energy implications.

[8] Energy and Buildings, 224, 110259.

[9] Li, Y., Li, J., Luo, X., & Li, H. (2014). A review of indoor environmental quality in buildings. Renewable and Sustainable Energy Reviews, 36, 164–180.

[10] Minke, G. (2012). Building with earth: Design and technology of a sustainable architecture. Birkhäuser.

[11] Nicol, J. F., & Humphreys, M. A. (2002). Adaptive thermal comfort and sustainable thermal standards. Energy and Buildings, 34(6), 563–572.

[12] Orosa, J. A., & Oliveira, A. C. (2012). Passive strategies for improving thermal comfort in educational buildings in hot climates. Building and Environment, 56, 112–120.

[13] Preiser, W. F. E., & Vischer, J. C. (2005). Assessing building performance. Routledge.

[14] Shield, B. M., & Dockrell, J. E. (2003). The effects of noise on children at school.

[15] The Journal of the Acoustical Society of America, 114(3), 1635–1645.