Tropical Built Environment Journal. Volume 13, No. 1, 61-84, 2026 www.tbejournal.com
ISSN: 1118-1790

PERFORMANCE-BASED PLANNING AND DESIGN OF UNIVERSITY BUILDING FACILITIES: USER-CENTRED POST-OCCUPANCY EVALUATION MODEL FOR ENHANCING USER SATISFACTION IN DELTA STATE, NIGERIA

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Abstract
University buildings should provide functional, comfortable and safe environments that support effective teaching and learning. However, shortcomings in space, accessibility, thermal comfort, lighting, ventilation, maintenance and other essential services may reduce users' satisfaction. This study evaluated the performance of selected university building facilities in Delta State, Nigeria, and developed a user-centred Post-Occupancy Evaluation (POE) model for improving building performance and user satisfaction. A descriptive survey design, supported by POE, was adopted. Data were obtained from 100 respondents, comprising 60 males (60%) and 40 females (40%), using a Building Facilities Performance Evaluation Questionnaire and an observation checklist. Data were analysed using Performance Difference (PD), weighted mean and independent-samples t-test at the 0.05 significance level. The findings revealed that 9 of the 15 facility-performance indicators had positive PD values, indicating satisfactory performance in several areas, while negative values were recorded for some indicators, particularly indoor temperature. Pearson correlation coefficient was used to determine the relationship between building performance and users' satisfaction among students and staffs in the selected universities. The independent-samples t-test showed no significant difference between respondents' views at the 0.05 level, suggesting general agreement in their assessment of the facilities. This consistency formed part of the basis for developing the proposed model. The User-Centred Performance-Based POE Model was developed from the identified performance gaps and users' expressed needs. It emphasizes continuous evaluation of functionality, space adequacy, accessibility, thermal comfort, lighting, ventilation, safety, maintenance and essential services. The study concludes that incorporating users' feedback into planning, design and facility management can promote better-performing university buildings and improve user satisfaction in Delta State.

Keywords: User-centred POE, post-occupancy evaluation, university buildings, building performance, users' satisfaction, facility management.

1.0 INTRODUCTION

1.1 Background to the Study

University buildings provide essential spaces for teaching, learning, research, administration, accommodation and other institutional activities. Their performance can influence users' comfort, satisfaction and productivity. In this regard, Kim, Abdou, Abdou, and Altan (2022) demonstrated that indoor environmental conditions in university

buildings are closely associated with occupants' satisfaction, particularly in relation to thermal conditions, lighting and indoor air quality.

Traditionally, building success has been assessed largely through compliance with approved designs, specifications, costs and construction standards. However, satisfactory completion does not necessarily guarantee satisfactory performance during actual use. Users may still experience inadequate space, poor ventilation, excessive heat, inadequate lighting, accessibility difficulties and maintenance problems. Dong, Zhao, Ren, Ge, and Chan (2022) showed that space design and size can significantly influence occupants' satisfaction with the indoor environment in university dormitories, demonstrating the importance of assessing buildings based on actual user experience.

Post-Occupancy Evaluation (POE) provides a systematic means of assessing buildings after they have been occupied. Lolli, Marinello, Coruzzolo, and Butturi (2022) explained that POE combines qualitative and quantitative information to identify differences between expected building performance and the actual conditions experienced by occupants. It can therefore provide useful feedback for improving building management, maintenance and future design decisions. The relevance of POE to university facilities has also been demonstrated in Nigeria. Ikediashi, Udo, and Ofoegbu (2020) evaluated buildings at the University of Uyo using users' assessments of technical and functional performance and found that POE could provide useful feedback for improving university facilities. Their study also identified limited awareness of POE and inadequate expertise as barriers to its wider application in universities.

University buildings are influenced by several interconnected factors, including functionality, space adequacy, accessibility, thermal comfort, lighting, ventilation, safety, cleanliness, maintenance and essential services. Kim et al. (2022) combined physical measurements with occupant satisfaction in a university building and demonstrated the value of considering both objective environmental conditions and users' perceptions when assessing building performance. Similarly, Weng, Zhang, Chen, Ying, Zhu, and Sun (2023) linked indoor environmental conditions with occupant satisfaction in university teaching buildings, further supporting the need for an integrated assessment approach. Despite the usefulness of POE, its application in Nigerian

universities remains limited and is often focused on individual buildings or specific aspects of performance. Recent evidence from public tertiary institutions in Abia State, for example, has highlighted continuing concerns about building maintenance practices, user satisfaction and facilities management. Okechukwu and Oladejo (2026) consequently emphasised the need for improved maintenance practices and greater attention to users' experiences in tertiary institutions.

A further concern is that findings from building assessments are not always systematically transferred into future planning and design. When problems relating to ventilation, space, comfort, maintenance or services are not documented and incorporated into subsequent projects, similar deficiencies may recur. Lolli et al. (2022) emphasised the value of POE feedback in identifying differences between designed and actual building performance, thereby providing a basis for continuous improvement. This need is particularly relevant to university buildings in Delta State, Nigeria, where growing student populations and environmental conditions create increasing demands for functional, comfortable, safe and accessible facilities. However, existing studies have not sufficiently developed an integrated, user-centred model that combines building performance indicators with users' satisfaction and provides feedback for facility management and future planning. The major gap is therefore the limited availability of an integrated user-centred Post-Occupancy Evaluation model specifically suited to university buildings in Delta State. Existing research has examined individual buildings, maintenance practices, indoor environmental quality or user satisfaction, but there remains a need to bring these dimensions together within a single performance evaluation framework. This study therefore proposes a User-Centred Post-Occupancy Evaluation Model for Enhancing User Satisfaction in University Building Facilities in Delta State, Nigeria.

1.2 Statement of the Problem

University buildings in Delta State are expected to provide adequate, safe, functional and comfortable spaces for teaching, learning, research, administration and accommodation. However, specific problems reported in Nigerian university buildings include inadequate classroom and laboratory spaces, overcrowding, poor ventilation, excessive indoor heat, inadequate lighting, unreliable electricity and water supply, poor sanitation, limited accessibility, and inadequate

maintenance. Ikediashi, Udo, and Ofoegbu (2020), in their post-occupancy evaluation of University of Uyo buildings, identified deficiencies in building performance and highlighted limitations in the systematic application of POE in Nigerian universities.

A major problem is that conventional building assessment often focuses on physical condition and compliance with design requirements without adequately capturing users' experiences. Yet, Lolli, Marinello, Coruzzolo, and Butturi (2022) demonstrated that POE can reveal differences between expected and actual building performance and provide feedback for improving future projects. Without such user-based assessment, deficiencies in thermal comfort, space adequacy, accessibility, ventilation, maintenance and essential services may persist. The research gap is the lack of an integrated user-centred assessment of university building performance in Delta State that simultaneously examines facility adequacy, actual performance, users' satisfaction and performance deficiencies. This study therefore evaluates selected university buildings in Asaba, Agbor, Ozoro, Abraka, Oleh and Kwale, determines their major performance deficiencies and relationship with user satisfaction, and develops a User-Centred Post-Occupancy Evaluation Model for improving university building planning, design, maintenance and management.

1.3 Aim and Objectives

Aim

The main aim of this study is to develop a user-centred Post-Occupancy Evaluation (POE) model for improving the planning and design of university building facilities and enhancing users' satisfaction in Delta State, Nigeria.

Objectives

1. To determine the performance of selected university building facilities in Asaba, Agbor, Ozoro, Abraka, Oleh and Kwale, Delta State, with emphasis on functionality, space adequacy, accessibility, thermal comfort, lighting, ventilation, safety and security, maintenance, indoor environmental quality, and essential building services.
2. To ascertain the relationship between building performance and users' satisfaction among students and staffs in the selected universities.
3. Develop and validate a user-centred Post-Occupancy Evaluation model that integrates building performance indicators and users' feedback to

support improved planning, design, management, maintenance and future development of university building facilities in Delta State.

1.4 Research Questions

The following research questions were developed to guide the study:

1. How well do the selected university building facilities in Asaba, Agbor, Ozoro, Abraka, Oleh, and Kwale perform in terms of functionality, adequacy of space, accessibility, thermal comfort, lighting, ventilation, safety and security, maintenance, indoor environmental quality, and essential building services?
2. What is the relationship between building performance and users' satisfaction among students, academic and staffs in the selected universities?
3. What building performance indicators and users' feedback are considered important for developing a user-centred Post-Occupancy Evaluation model for improving the planning, design, management, maintenance, and future development of university building facilities in Delta State?

1.4 Hypothesis

Null hypotheses was be tested at the 0.05 level of significance:

1. There is no statistical significant difference in the mean ratings of students and staffs of universities on performance-Based Planning and Design of University Building Facilities: A User-Centred Post-Occupancy Evaluation Model for Enhancing User Satisfaction in Delta State, Nigeria

2.0 LITERATUREREVIEW

University buildings are expected to support teaching, learning, research, administration and accommodation effectively. Performance-based planning and design therefore focuses not only on compliance with drawings and construction standards but also on how well completed buildings perform under actual conditions of use. In university environments, performance can be assessed through factors such as functionality, space adequacy, accessibility, thermal comfort, lighting, ventilation, safety, maintenance and essential services. Hassanain, Sanni-Anibire, and

Mahmoud (2024), for example, assessed university building performance using technical, functional and behavioural indicators and related these indicators to users' satisfaction.

Post-Occupancy Evaluation (POE) provides an important mechanism for determining whether buildings achieve their intended performance after occupation. It combines information about the physical and functional conditions of buildings with occupants' experiences and perceptions. Lolli, Marinello, Coruzzolo, and Butturi (2022) explained that POE can identify differences between expected and actual building performance and provide feedback for improving building management and future projects. Thus, POE provides a link between building design, actual performance and subsequent planning decisions.

User satisfaction is an important component of building performance because occupants experience the building directly during everyday activities. In a Nigerian university context, Ikediashi, Udo, and Ofoegbu (2020) used POE to assess both technical and functional performance of University of Uyo buildings and demonstrated the usefulness of users' feedback in identifying areas requiring improvement. Similarly, Ayodele and Adegoke (2021) found that indoor environmental quality and supporting services influenced students' satisfaction with university halls of residence at Obafemi Awolowo University.

3.0 METHODOLOGY

3.1 Study Area

The study was conducted in Delta State, Nigeria, located in the South-South geopolitical zone of the country. Delta State lies approximately between 5°00′ and 6°30′ N latitude and 5°00′ and 6°45′ E longitude. The state is bounded by Edo State to the north, Anambra and Rivers States to the east, Bayelsa State to the southeast, and the Atlantic Ocean to the south. Delta State has a

tropical climate characterised by relatively high temperature, humidity and substantial rainfall, conditions that are relevant to the performance of university buildings, particularly in relation to ventilation, thermal comfort, lighting and indoor environmental quality. The study covered six selected universities distributed across different parts of Delta State. These are Admiralty University of Nigeria (ADUN), Ibusa; Federal University of Health Sciences, Kwale (FUHSK); Delta State University (DELSU), Abraka; University of Delta State (UNIDEL), Agbor; Delta State University of Science and Technology (DSUST), Ozoro; and Dennis Osadebay University (DOU), Asaba. The institutions comprise both Federal and State universities, thereby providing a basis for comparing building performance and users' satisfaction across different institutional ownership structures.

The selected universities provide a range of academic, administrative, residential, recreational, health and support facilities used by students and staff. Their buildings vary in age, function, design and level of development, making them suitable for assessing actual building performance from the users' perspective. The study therefore focuses on how effectively these facilities meet users' needs regarding functionality, space adequacy, accessibility, thermal comfort, lighting, ventilation, safety, maintenance, cleanliness and essential services. The geographical distribution of the selected universities also provides a useful basis for examining building performance under different local environmental and institutional conditions within Delta State. The study consequently uses the six institutions as representative cases for developing a User-Centred Post-Occupancy Evaluation Model for enhancing user satisfaction and informing future planning, design, maintenance and management of university building facilities in Delta State.

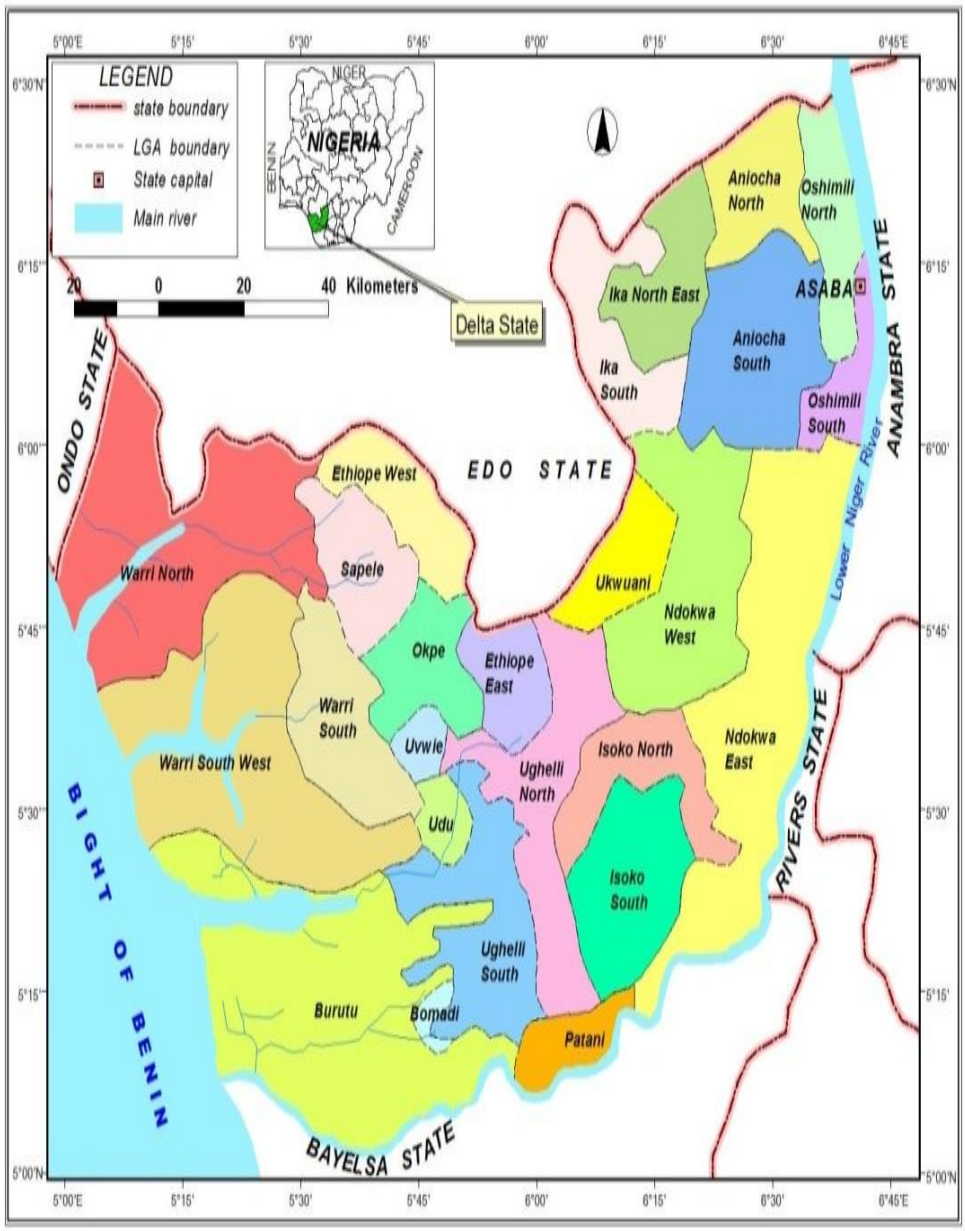


Figure 3.1 Map of Delta State showing its Local Government Areas.
Source: Digitized google maps (2026)

3.2 Research Design

The study adopted a descriptive survey design combined with Post-Occupancy Evaluation (POE) to assess the performance of selected university buildings and examine its relationship with users' satisfaction in Delta State, Nigeria.

3.3 Population of the Study and Sample Size

The study population comprised students, academic staff and non-academic staff of the six selected universities in Delta State. A multistage sampling procedure was used to select 100 respondents from the institutions.

3.4 Data Collection and Instrument for Data Collection

Both primary and secondary data were used. Primary data were collected from students, academic staff and non-academic staff through a structured questionnaire and direct observation, while secondary data were obtained from relevant books, journals, reports, institutional documents and previous studies. Data collection instruments comprised the University Building Performance Questionnaire (UBPQ) and a Building Performance Observation Checklist. The instruments assessed functionality, space adequacy, accessibility, thermal comfort, lighting, ventilation, safety and security, maintenance, indoor environmental quality, and essential building services. The UBPQ adopted a five-point scale ranging from Very Good Performance (5) to Very Poor Performance (1). The instruments were validated by experts and pilot-tested with 10 respondents. The UBPQ achieved a Cronbach's Alpha reliability coefficient of 0.83, indicating satisfactory reliability.

3.5 Method of Data Analysis

Data were analysed using SPSS Version 22. Weighted mean and performance index were used to summarize responses, while the Performance Difference (PD) method was used to determine performance gaps:

$PD = X_p - X_n$

Where X_p represents the observed/perceived performance score and X_n represents the

expected or benchmark performance score. A positive PD indicates performance above the benchmark, while a negative PD indicates performance below the benchmark. An independent-samples t-test was used at the 0.05 significance level to compare the perceptions of students and staff, while Pearson's correlation analysis was used to determine the relationship between building performance and users' satisfaction. The proposed User-Centred POE Model was developed from relevant literature, existing POE frameworks and the study findings. The preliminary model was assessed by experts in architecture, engineering, facility management, planning and related fields. The Content Validity Index (CVI) was used to evaluate the model's relevance, clarity, completeness, applicability and logical consistency. The model was subsequently revised based on the experts' recommendations.

4.0 DATA PRESENTATION AND ANALYSIS

4.1 How well do the selected university building facilities in Asaba, Agbor, Ozoro, Abraka, Oleh, and Kwale performed

Table 4.1. Performance Gap Analysis of the Mean Responses of Respondents for the university building facilities in Asaba, Agbor, Ozoro, Abraka, Oleh, and Kwale perform in terms of functionality, adequacy of space, accessibility, thermal comfort, lighting, ventilation, safety and security, maintenance, indoor environmental quality, and essential building services?

S/N	Building Performance Statement	N	Xp	Xn	$X_p - X_n$	Remark
1	The building provides spaces that are suitable for the activities for which they are intended.	100	4,6	2,1	2,5	P
2	The available space is adequate for the number of people using the building.	100	4.5	2,2	2.3	P
3	Users can easily enter and move around the building.	100	4.7	2,0	2.7	p
4	The indoor temperature is generally comfortable during normal use.	100	2.1	2.30	-0.2	NP
5	The building provides adequate protection against excessive heat.	100	2.2	2.50	-0.3	NP
6	The building receives sufficient natural and artificial lighting for normal activities.	100	2.5	2.50	0	NP

7	The building provides adequate natural airflow and ventilation.	100	2.30	2.40	-1.0	NP
8	The building provides adequate measures for users' safety and security.	100	3.8	2.40	1.4	P
9	Fire-safety equipment and emergency exits are adequately provided and accessible.	100	2.4	2.50	-1.0	NP
10	Building faults and defects are attended to within a reasonable time.	100	4.2	2.10	2.2	P
11	The building is regularly cleaned, inspected, and maintained.	100	3.6	2.20	1.4	P
12	The indoor environment is generally clean, healthy, and comfortable.	100	3.7	2.20	1.7	P
13	Noise levels within the building are generally acceptable.	100	3.5	2.02	1,48	P
14	Electricity, water, sanitation, and other essential services are reasonably reliable.	100	2.4	2.70	-0.3	NP
15	Overall, the building performs effectively for the purpose for which it was provided.	100	3.6	2.50	1.1	P

Performance (p) Non-Performance (NP)

The results in Table 1 show that nine out of the fifteen building performance indicators recorded positive performance gap values, ranging from 1.1 to 2.7. This indicates that the selected university buildings performed satisfactorily in several important areas. Users generally considered the buildings suitable for their intended purposes, with reasonably adequate space, easy accessibility and movement, satisfactory cleanliness, acceptable indoor environmental conditions, manageable noise levels, and attention to safety, security, and building defects. However, six indicators recorded negative performance gaps, ranging from −0.3 to −1.0, pointing to areas where the buildings did not meet users' expectations. The major weaknesses were related to thermal comfort, excessive heat, lighting, ventilation, fire-safety provisions, emergency exits, and the reliability of essential services such as electricity, water, and sanitation. The findings suggest that the university buildings were generally functional and usable, but some important environmental and service-related deficiencies remain. Greater attention should therefore be given to improving thermal conditions, lighting, air circulation, fire safety, and basic building services. Addressing these areas through effective planning, design, maintenance, and post-occupancy interventions could improve the quality of the

facilities and enhance the satisfaction of students and staff.

4.2 What is the relationship between building performance and users' satisfaction among students and staffs in the selected universities?

Table 4. 2. Performance Gap Analysis of the Mean Responses of Respondents relationship between building performance and users' satisfaction among students and staffs in the selected universities

S/N	Building Performance and User Satisfaction	N	Xn	Xp	$X_p - X_n$	Remark
16	The suitability of building spaces for their intended activities influences my satisfaction.	100	4,6	2,1	2,5	S
17	Adequate space for users contributes to my satisfaction with the building.	100	4.5	2,2	2.3	S
18	Ease of access and movement within the building affects my satisfaction.	100	4.7	2,0	2.7	S
19	Comfortable indoor temperature contributes to my satisfaction with the building.	100	2.1	2.30	-0.2	NS
20	Protection from excessive heat influences my overall satisfaction.	100	2.2	2.50	-0.3	NS
21	Adequate lighting contributes to my satisfaction with the building.	100	2.5	2.50	0	NS
22	Good ventilation and fresh air influence my satisfaction with the building.	100	2.30	2.40	-1.0	NS
23	The level of safety provided by the building affects my satisfaction.	100	3.8	2.40	1.4	S
24	Adequate security measures contribute to my confidence and satisfaction as a user.	100	2.4	2.50	-1.0	NS
25	Prompt repair of damaged building components contributes to my satisfaction.	100	4.2	2.10	2.2	S
26	The cleanliness and general condition of the building affect my satisfaction.	100	3.6	2.20	1.4	S
27	Good indoor air quality and acceptable noise levels contribute to my satisfaction.	100	3.7	2.20	1.7	S
28	Reliable electricity, water, and sanitation services influence my satisfaction.	100	3.5	2.02	1.48	S
29	The availability of other essential services, such as internet connectivity, affects my satisfaction.	100	2.4	2.70	-0.3	NS
30	Overall, the performance of the university building has a significant influence on my satisfaction	100	3.6	2.50	1.1	S

Satisfactory (S) **Not Satisfactory (NS)**

Table 2b: Pearson Product-Moment Correlation Table

Variables	N	Pearson r	*p*-value	Relationship
Building Performance	100	0.625	0.05	Strong
and Users' Satisfaction	100	0.625	0.05	strong

$p < .01$ (2-tailed).

Correlation is significant at the 0.01 level (2-tailed).

The relationship between building performance and users' satisfaction was examined using the Pearson Product-Moment Correlation (r). The analysis was based on the respondents' composite scores for building performance and users' satisfaction. The result showed a positive relationship between the two variables, indicating that improvements in building performance were generally associated with higher levels of user satisfaction. The strength and significance of the relationship were determined using the Pearson correlation coefficient and its corresponding *p*-value at the 0.05 level of significance. The results presented in Table 2a further show that several building performance attributes recorded positive Performance Difference (PD) values. These included the suitability of building spaces (2.5), adequacy of space (2.3), ease of access and movement (2.7), safety (1.4), prompt repair of damaged components (2.2), cleanliness and general condition (1.4), indoor air quality and acceptable noise levels (1.7), essential building services (1.48), and overall building performance (1.1). These positive values suggest that users considered these aspects of the facilities satisfactory relative to the established performance benchmark. However, some areas recorded negative PD values, including indoor temperature (−0.2), protection from excessive heat (−0.3), ventilation (−1.0), security measures (−1.0), and internet connectivity (−0.3). These findings point to areas where building performance fell below the expected level and may have reduced users' satisfaction.As shown in Table 2b, the Pearson correlation result was $r = 0.60$, $p < 0.05$. This indicates a moderate, positive and statistically significant relationship between building performance and users' satisfaction. Therefore, better building performance is associated with

greater satisfaction among students and staff in the selected universities.

4.3 What building performance indicators and users' feedback are considered important for developing a user-centred Post-Occupancy Evaluation model for improving the planning, design, management, maintenance, and future development of university building facilities in Delta State?

Table 4.3. Performance Gap Analysis of the Mean Responses of Respondents for the university building facilities performance indicators for developing the post-occupancy evaluation model

S/N	Indicators for Developing the Post-Occupancy Evaluation Model	N	Xp	Xn	$X_p - X_n$	Remark
31	Functionality of spaces and facilities should be included in the POE model.	100	4,6	2,1	2,5	I
32	Adequacy of space should be considered when evaluating university buildings.	100	4.5	2,2	2.3	I
33	Accessibility and ease of movement should form part of the evaluation.	100	4.7	2,0	2.7	I
34	Thermal comfort should be assessed as an important aspect of building performance.	100	3.50	2.30	1.20	I
35	Lighting and ventilation should be included in the evaluation.	100	3.8	2.50	1.3	I
36	Safety and security provisions should be assessed regularly.	100	3.5	2.50	1.0	I
37	The physical condition and maintainability of buildings should be evaluated.	100	2.40	2.30	0.1	I
38	Indoor environmental quality should be considered in assessing building performance.	100	3.8	2.40	1.4	I
39	Availability and reliability of essential building services should be assessed.	100	4.6	2.50	2.10	I
40	Students' opinions should be regularly obtained when evaluating university buildings.	100	4.2	2.10	2.2	I
41	Academic staff should be given opportunities to provide feedback on building performance.	100	3.6	2.20	1.4	I
42	Non-academic staff should also participate in evaluating university facilities.	100	3.7	2.20	1.7	I
43	Users' complaints and suggestions should be considered when planning maintenance and improvements.	100	3.5	2.02	1,48	I

Included (I) Not Included(NI)

Table 3 shows that all 13 indicators in Table 3 recorded positive PD values ranging from 1.0 to 2.7, confirming their relevance to the proposed POE framework. Furthermore, the analysis revealed a moderate positive and statistically significant relationship between building performance and users' satisfaction ($r = 0.625$, $p < 0.05$). This finding provides empirical support for incorporating users' satisfaction into the assessment of university building performance. The proposed User-Centred Post-Occupancy Evaluation (POE) Model was developed from relevant literature, existing POE approaches, and the findings obtained from the study. The model views university building development as a continuous process rather than one that ends when construction is completed.The process starts with planning and design, where the purpose of the building, users' needs and other requirements are considered. These decisions influence the characteristics of the completed building, such as functionality, space adequacy, accessibility, thermal comfort, lighting, ventilation, safety, maintenance and essential services.

Once the building is occupied, students, academic staff and non-academic staff interact with the facilities during their daily activities. Their experiences provide the basis for Post-Occupancy Evaluation. Information is obtained through questionnaires and direct observation to determine how well the facilities perform under actual conditions of use.The POE findings provide user feedback on areas that perform satisfactorily and those that require attention. The Performance Difference (PD) analysis is then used to identify these areas. A positive PD indicates that performance is above the established benchmark, while a negative PD points to a performance shortfall that may require improvement. The identified gaps provide a basis for maintenance and improvement, including repairs, facility upgrades and improvements in comfort, safety and essential services. The lessons obtained from the occupied buildings are then used to guide future planning and design. This creates a continuous feedback process in which users' experiences with existing facilities contribute to better decisions for subsequent building projects.

The model can therefore be summarized as:

Planning and Design → Building Characteristics → Occupancy → POE → User Feedback → Performance Assessment → Maintenance/Improvement → Future Planning and Design

What distinguishes the proposed model is its emphasis on continuous user feedback. Rather than viewing POE simply as an assessment conducted after a building is occupied, the model uses POE findings to identify performance gaps, guide maintenance and improvement, and provide lessons for future planning and design. It therefore provides a user-centred and performance-based approach that responds to the actual experiences of university building users in Delta State.

4.3 Hypothesis

Ho. There is no Statistical significant difference in the mean ratings of students, and staff ratings on User-centred Post-Occupancy Evaluation (POE) model for improving the planning and design of university building facilities and enhancing users' satisfaction in Delta State

Table 4.4: Summary of t-test Analysis of the Mean Responses of students, and staff ratings on User-centred Post-Occupancy Evaluation (POE) model for improving the planning and design of university building facilities and enhancing users' satisfaction in Delta State

S/N	User-Centred Post-Occupancy Evaluation (POE) Model	$\dot{X}1$	$\dot{X}2$	Sig	Sig(2-tailed)	LO	UP	Remark
1	Users' views should be obtained regularly to determine whether university buildings meet their needs.	2.97	3.6	0.04	0.01	-0.23	0.23	NS
2	Students, academic staff, and non-academic staff should all participate in evaluating university buildings after occupation.	2.87	3.22	0.01	0.09	-0.73	0.03	NS
3	The functionality of building spaces should be assessed to determine how well they support teaching, learning, research, and administrative activities.	3.03	3.54	0.38	0.02	-0.06	0.08	NS
4	Adequacy of space should be considered when evaluating the performance of university buildings.	2.94	3.58	0.12	0	-1.05	-0.23	NS
5	Thermal comfort, ventilation, and indoor air quality should be included in post-occupancy assessment.	2.71	2.92	0.01	0.29	-0.59	0.17	NS
6	Lighting and natural ventilation should be evaluated because they influence users' comfort and productivity.	2.94	3.58	0.12	0	-1.05	-0.23	NS
7	Safety, security, accessibility, and emergency facilities should form part of the POE process.	2.71	2.92	0.01	0.29	-0.59	0.17	NS
8	The condition, cleanliness, and maintainability of university buildings should be regularly assessed.	2.87	3.22	0.01	0.09	-0.73	0.03	NS
9	Users' complaints and suggestions should be used to guide maintenance, renovation, and improvement decisions.	3.03	3.54	0.38	0.02	-0.06	0.08	NS

10	Findings from post-occupancy evaluations should be used to improve the planning and design of future university building projects	2.71	2.92	0.01	0.29	-0.59	0.17	NS

S=Significant difference NS = No Significant difference

The results presented in Table 4 indicate that the 95% confidence intervals for all ten building-facility indicators (Items 1–10) crossed zero, with the lower limits being negative and the upper limits positive. This pattern suggests that there was no statistically significant difference in the ratings provided by students, academic staff, and non-academic staff concerning the User-centred Post-Occupancy Evaluation (POE) model for improving the planning and design of university building facilities and promoting users' satisfaction in Delta State.In practical terms, the finding means that the three groups of respondents expressed largely comparable opinions about the usefulness of the User-centred POE model. Although the respondents may have had different roles and experiences within the university environment, their assessments of the identified building-facility indicators were sufficiently similar that the observed differences could not be regarded as statistically meaningful. Based on this result, the null hypothesis which states that there is no statistically significant difference in the mean ratings of students, academic staff, and non-academic staff regarding the User-centred POE model for improving the planning and design of university building facilities and enhancing users' satisfaction in Delta State is not rejected for the indicators whose confidence intervals contained zero. The finding therefore points to a reasonable level of agreement among the three respondent groups regarding the contribution of user-centred POE to the planning, design, and improvement of university building facilities.

5.0 DISCUSSION OF RESULTS/FINDING

Building Performance of the Selected University Facilities

The findings in Table 1 indicate that nine of the fifteen building-performance indicators had positive Performance Difference (PD) values, ranging from 1.1 to 2.7. This suggests that the selected university buildings performed reasonably well in several important areas. Users were generally positive about the suitability and adequacy of spaces, accessibility, safety, cleanliness, maintenance, indoor conditions, noise levels and the overall usability of the facilities.

The result suggests that many of the buildings are capable of supporting teaching, learning, administrative activities and other functions for which they were designed. In other words, the basic functionality of the facilities appears to be satisfactory from the users' perspective. This finding is consistent with Ikediashi (2020), who reported satisfactory performance in some aspects of university

buildings in Nigeria based on users' assessments.

Despite these positive results, six indicators recorded negative PD values, ranging from −0.3 to −1.0. The areas of concern included indoor temperature, protection from excessive heat, lighting, ventilation, fire-safety provisions, emergency exits and some essential building services. These deficiencies are important because they can affect users' comfort, safety, concentration and productivity.

The findings agree with Bae et al.(2021), who emphasized the influence of thermal conditions, lighting and other indoor environmental factors on students' satisfaction with higher-education facilities. Similarly, Munonye, C., & Ji, Y. (2020).) highlighted the importance of thermal comfort, lighting and ventilation in Nigerian university learning environments. The implication is that providing adequate building space alone does not guarantee satisfactory performance. The conditions experienced by occupants while using the facilities must also be considered.

Building Performance and Users' Satisfaction

The results presented in Table 2 show a similar pattern. Nine of the fifteen indicators recorded positive PD values between 1.1 and 2.7, indicating generally favorable perceptions of the buildings' functionality, space provision, accessibility, cleanliness, safety, maintenance, indoor environmental conditions and overall usefulness.

However, six indicators recorded negative PD values ranging from −0.3 to −1.0. These areas point to shortcomings in thermal comfort, protection from excessive heat, lighting, ventilation, fire protection, emergency exits and essential services such as electricity, water and sanitation. Such deficiencies can influence users' everyday experiences and may reduce their satisfaction with the facilities.

This finding agrees with Adegoke (2020), who found that physical characteristics, indoor environmental conditions and supporting services were important factors in users' assessment of university residential facilities. The finding therefore suggests that facility managers should look beyond visible structural defects and pay attention to less obvious factors such as air movement, indoor temperature, lighting quality and the reliability of basic services.

Indicators for the Proposed User-Centred POE Model

The findings in Table 3 provide a direct empirical basis for constructing the proposed model. All thirteen indicators recorded positive PD values, ranging from 1.0 to 2.7. This indicates that respondents considered all the identified indicators relevant to evaluating university building performance through a user-centred POE approach.

The result demonstrates that building performance is not a single-dimensional issue. Users' assessments cover several interconnected areas, including functionality, space adequacy, accessibility, thermal comfort, lighting, ventilation, indoor environmental quality, safety and security, maintenance and essential building services. These dimensions were therefore retained as major components of the proposed model.

This finding supports Li (2018), who described POE as an important approach for understanding how buildings perform under actual conditions of use and emphasized the value of occupants' experiences. It is also consistent with Dam-Krogh (2024), whose work highlights the importance of indoor environmental quality and users' experiences in POE studies.

The finding further suggests that feedback from students, academic staff and non-academic staff should be incorporated into university facility evaluation. These users interact with buildings regularly and may identify problems that are not easily detected through technical inspection alone. Combining their experiences with physical assessment can therefore provide a more complete picture of building performance.

The results in Table 4 show that the 95% confidence intervals for the ten building-facility indicators included zero, with the intervals extending from negative to positive values. This indicates that the differences in the responses of students, academic staff and non-academic staff were not statistically significant.

In simple terms, the three categories of respondents generally expressed similar views about the performance of the university facilities. Although their patterns of building use may differ, the differences in their assessments were not large enough to establish a statistically significant variation.

This finding strengthens the basis for the proposed user-centred POE model because it suggests that the identified building-performance concerns are not limited to one particular category of users. Instead, they reflect issues experienced or recognized

across the wider university community. Including students, academic staff and non-academic staff in POE can therefore provide a broader and more balanced assessment of facility performance.

The finding is consistent with the occupant-centred emphasis of POE discussed by Li (2018) and the stakeholder-oriented assessment reported by Ikediashi (2020). However, the absence of a statistically significant difference should not be interpreted as meaning that the three groups gave exactly the same ratings. Rather, the observed differences were not statistically significant at the chosen level of testing.

5.1 Conclusion and Recommendations

The study concludes that the selected university buildings in Delta State generally perform their intended functions and adequately support teaching, learning and administrative activities. However, thermal discomfort, poor ventilation and lighting, inadequate fire-safety provisions, unreliable electricity and water supply, and sanitation deficiencies remain important performance concerns. The findings also indicate that building performance is closely associated with users' experiences and satisfaction. Students, academic staff and non-academic staff generally shared similar perceptions of the facilities, indicating that the identified deficiencies are institutional concerns rather than problems affecting only a particular user group. The study further concludes that Post-Occupancy Evaluation (POE) provides a useful basis for assessing both the physical performance of university buildings and users' experiences. The proposed User-Centred POE Model can therefore support regular assessment, maintenance, facility management and future planning and design, with the overall aim of improving building performance and user satisfaction in universities in Delta State.

Based on the findings of the study, the following three recommendations are made:

1. Improve Thermal Comfort and Safety: Universities should improve ventilation, shading, lighting and thermal conditions, while

strengthening fire-safety facilities, emergency exits and evacuation arrangements.

2. Strengthen Maintenance and Essential Services: Universities should adopt preventive maintenance programmes and ensure reliable electricity, water supply, sanitation and other essential building services.
3. Institutionalise User Feedback and POE: Universities should conduct regular Post-Occupancy Evaluation (POE) and incorporate feedback from students, academic staff and non-academic staff into facility management, renovation and the planning and design of future buildings.

5.2 Contribution to Knowledge

The study contributes to knowledge by developing a User-Centred Post-Occupancy Evaluation (POE) Model for assessing university building performance and user satisfaction. It provides empirical evidence on key performance deficiencies, particularly thermal comfort, ventilation, lighting, fire safety, electricity, water supply and sanitation, and demonstrates the importance of integrating users' feedback with physical building assessment to improve facility management, maintenance, planning and future design.

5.3 Areas for Further Research

Future studies should examine university buildings across different seasons and climatic regions of Nigeria. Further research could also combine users' perceptions with direct measurements of temperature, humidity, ventilation, lighting and energy use, and test the proposed User-Centred POE Model across more universities and building types to establish its wider applicability.

5.4 AI Declaration

Artificial Intelligence (AI) tools, specifically ChatGPT, were used solely for language

refinement, editorial support, organisation and presentation of the manuscript. All research data, analysis, interpretation, findings and conclusions were independently generated by the author. The author takes full responsibility for the accuracy and integrity of the work.

5.5 Conflict of Interest

The author declares no conflict of interest regarding the conduct, analysis, interpretation or publication of this research.

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