



Educational Buildings Defects and Health Impact on Users: A Case of Lagos State Polytechnic, Nigeria

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Abstract—Education serves as the bedrock for future socio-economic development of any society. Student's learning behaviour and effectiveness is affected by functionality of educational buildings. During the lifecycle of buildings its performance is affected by defects, hence, it is paramount to have effective maintenance policies and practices. Thus, in order to retain sustainable educational building, defects diagnosis and management is paramount. The study seeks to identify defects and its associated health issues in Lagos State Polytechnic campuses. The objectives were achieved using questionnaire survey, responses of 200 participants were coded and analysed with SPSS 17. The study reveals that plumbing installations, indoor environment and aesthetic related issues are critical problems that need attention in the institution. Based on the responses, heat, discomfort and body pain were significant health problems experienced by users of facilities. This is an indication of areas the management of the institution has to address in order to achieve its vision.

Keywords— Defects, campus, educational buildings, facilities, Polytechnic

I. INTRODUCTION

The wide gap between knowledge and skills in developing countries especially in the academic environment has made education an imperative device in the formative procedure. Education is therefore said to provides critical manpower and expertise needed to develop the economy and the formative procedure of any nation.[1] opined that education is thought to be the best approach to societal values, innovation, profitability and monetary development. In Nigeria, polytechnics are charged with the obligations of providing a center level specialized labor for the industries. Therefore, since learning a critical element in education take place indoor; so buildings are essential to educational

institutions. The condition and nature of structures in which individuals live, work and learn mirrors a country's prosperity [2]. A number of studies [3],[4],[5] have confirmed the positive correlation between the quality of school facilities and academic performance. Therefore, there is a need to assess building defects that affect users of academic buildings; this will ultimately enhance performance of users since it is within educational buildings that, professionals, researchers and future pioneers are produced [6] Several studies have been conducted on maintenance and performance of buildings in Nigeria. For instance, [7] studied the factors affecting maintenance of public buildings; [8] carried out a post occupancy evaluation of public office buildings; [9] studied the maintenance management practice in public hospital buildings; post occupancy evaluation of postgraduate hostel facilities at the University of Lagos was conducted by [10] study focused on performance evaluation of educational facilities in South-East Nigeria. All these studies have revealed that the condition and state of some institutional buildings in Nigeria are appalling and also highlighted the reasons for neglect of maintenance. There has been few or no study that focused on defects in Polytechnic buildings in Nigeria, this study aims to address this gap.

This study seeks to identify building defects and their related health complaints in Lagos State Polytechnic (LASPOTTECH) campuses. In turn, the study will address the following questions: - What are the common building defects experienced by polytechnic building users? What are the critical defects experienced by polytechnic building users? What is the significant building defect related health complaint experienced by polytechnic building users based on their school affiliation?, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

II. PREVIOUS STUDIES ON EDUCATIONAL BUILDING

A post occupancy evaluation of postgraduate hostel facilities was conducted by [10] at the university of Lagos. The study reveals that occupants are dissatisfied with internet facilities, noise from outside the building, common room space, interior design of the rooms, telephone framework, cooking facilities and room temperature amid the dry season.

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Likewise, [11] examined the facilities performance of five Federal universities in South-West Nigeria and discovered that none of the part of indoor building condition is really agreeable. He confirms that users are dissatisfied on issues regarding security and health, ventilation, noise and air quality, and level of cleanliness which does not facilitate effective learning process in the university system. But in [12] analysis of defects in university buildings based on user's perspective in Malaysia. He identified 32 building defects in which 20 defects were found to be very critical to the building users. The results of the study show that faulty electrical systems, faulty air conditioning system and roof damages were the defects requiring urgent maintenance. Olanrewaju, was also able to relate the defects condition to the well-being of the users. Truly, building performance should be based on the condition of the facilities (defects) which determines the level of performance of such buildings. If a component is not defective, it's expected to perform optimally.

A. Facilities and workplace

The state of facilities in a learning environment usually determines the user's performance. Buildings are meant to be occupied. Building users are the occupants utilizing it. Hence, the satisfaction perception of the end users is determined by the interaction between the facilities and the users. The satisfaction perception of the facility users is derived from the ability of the building to enhance performance, environmental comfort and ultimately enhance staff's performance [13]. The issue of maintenance cannot be overemphasis in sustaining a functional building. Building maintenance function is not just to ensure the functionality of facilities at maximum efficiency, but to connect that performance to the user requirements [14]. [15], in her study on facility management practices in higher education buildings confirms that facility management can improve the physical performance and appearance of the building and its systems, it can also increase the level of satisfaction that the users feel while staying/working/teaching/learning in that building, improve the efficiency with which the building is maintained and operated. Even, indoor environments affect productivity and health problems and therefore worker performance [16].

Building comfort level assessment play a critical role in influencing the health complaints and building general sufficiency level judgement of the employees and the health complaints level also has a significant effect on the building general sufficiency [17]. workplace environment condition, such as lighting, indoor air quality, ergonomics and acoustics, have gained attention as part of the growth in interest for internal and external customer satisfaction and a significant relationship between worker's satisfaction and performance. It is vital then to diagnose any defective components that constitute the workplace environment condition [17].

III. STUDY AREA

Lagos State Polytechnic is a State Government owned institution and currently operates from three campuses (Ikorodu, Isolo and Surulere). The institution was established by promulgation Lagos State Edict No. 1 of 1978, and on August 1, 1978, the School of Agriculture in Ikorodu was merged with the institution and the merger formed the nucleus of the present-day permanent site at Ikorodu. The Polytechnic operates five schools namely: School of Management and Business Studies (SM & BS), School of Engineering (SENG), School of Environmental Studies (SES), School of Agriculture (SOA), and School of Technology (SST). The institution has a staff of over 964 (academic and non-academic), a large student population, comprising 6,030 full-time and over 12,000 part-time students and 52 accredited programmes in 31 academic departments across the various schools. The Polytechnic awards two classes of degree ordinary national diploma (OND) and higher national diploma (HND).

IV. RESEARCH METHOD

A survey research approach method was adopted for the study. In which a questionnaire survey and observation was used to gather information on the state of condition of polytechnic campus facilities, from the users of the educational environment. The survey was used to carry out a Post Occupancy Evaluation (POE) which provides a greater depth of qualitative and quantitative data and a contextual background to the building user's environment [18],[19],[20],[21]. It must be noted that some of the study's variables were identified from previous studies [12],[10],[9]. An investigative POE was done to identify building defects and related health complaints of users. Questionnaire was developed and used to gather individual level data from the facilities users (students (full time) and staffs); this is similar to the method used in [12] study on defects in Malaysian Universities. Thirty-five (35) defects and twelve (12) related health complaints were identified as study's variables. The questions were based on a four-point Likert scale; the respondents were asked to rate the level of criticality of the defects in the buildings and the significance of the related health complaints experienced within the environment.

A. Data Analysis and characteristic of study population

The mean scores obtained from Statistical Package for Social Scientist (SPSS) were ranked and used to address survey questions. Descriptive statistics was employed to analyze the perception of respondents experienced based on their schools. Based on the mean scores the factors were classified as follows: very critical (4.00-3.50), critical (3.50-2.51), less critical (2.50-1.51), and not critical (1.50-1.00). This classification serves as a means of identifying critical defects that affect users. A total of 250 questionnaires were administered on the building users. In all, 200 questionnaires

were used. This is a response rate of 80 per cent, which is considered satisfactory to report these findings. Table 1, shows the distribution of the respondents in terms of designation. The analysis revealed that 82.5% students, 10% academic staffs and 7.5% non-academic staffs participated in the survey.

TABLE I.
RESPONDENT PROFILE

<i>Participants</i>	<i>Frequency</i>	<i>Percent</i>
Students	165	82.5
Academic Staffs	20	10
Non- academic staffs	15	7.5
Total	200	100

V. RESULTS

The user's perception survey on the level of critically of building defects in the school was examined. Table 2, summaries the mean scores of the user's perception of the facility defects in each school in the Polytechnic and the overall mean for the institution. The mean score for each criterion (defect) range from 3.70-1.80.

A. *School of Management and Business Studies (SM & BS):*

The results reveal that water overflow from faulty cistern were very critical in the school. Damaged water taps and faded paint were also identified to be very critical in the school and requires urgent maintenance. Door and window frames, rough connection of air condition duct pipes, cob webs in classroom, defaced walls, and dampness on toilet walls were considered to be critical in nature and needs attention.

B. *School of Engineering (SENG):*

According to Table 2, dampness on toilet walls, damaged water taps and water closet, un-drained toilet floor water, burnt fluorescent lamp, faded paints, cob webs in the workshop and laboratory were critical defects in the learning environment that requires attention.

C. *School of Environmental Studies (SES):*

In the school, dampness on toilet walls, damaged water taps and water closet, pipe leakages, overgrowth of green areas, defaced walls, rough connection of air conditioners duct pipes, damage ceiling in classrooms, cob webs in offices, workshops and classrooms, Damaged class boards, door and window frames, air conditioners, electrical installations, door locks, internal doors and roof covering were all critical defects in the school as perceived by the respondents.

D. *School of Technology (SST):*

The respondents perceived as critical defects; overflow of W.C water, un-drained toilet floor water, defaced of walls, faulty air conditioners, damage ceiling, water closets, offices ceiling, doors and windows frame and overgrowth of green areas and so on (see Table, 2).

E. *School of Agriculture (SOA):*

The defects identified in the school as critical were overflow of W.C water, overgrowth of green areas, cob webs in classrooms, faded paint, un-drained toilet floor water, defaced of walls, deteriorated floor finish, internal doors, broken windows and damage railings.

In general, the overall weight of the building defects as perceived by users of the institutional facilities as shown in Table 2, it reveals that overflow of W.C water (3.00) and un-drained toilets floor water (3.00) are the most critical defects. Also dampness on toilet walls (2.90), damage water taps (2.90), water closet (2.90) and defaced walls with posters (2.90) were other critical defects noted in the educational buildings. Defects like roof covering (2.40), wall cracks (2.20), un-drained water on road and parks (2.30), and plant/algae growth on wall and roof top (2.30) were considered to be less critical in the institution. In addition, most noticeable defects in the campus are damage water taps, water closets, air conditioners and roof covering, and also broken windows with railings, rough installation of AC systems, and water logged road and car parks (see Table 3).

TABLE II.

SIGNIFICANCE OF BUILDING DEFECT

Defects in School buildings	SM & BS		SENG		SES		SST		SOA		Overall	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Overflow of W.C water	3.70	1	2.70	6	2.90	8	3.10	1	2.90	1	3.00	1
Un-drained toilet floor water	3.20	7	2.80	3	3.20	1	3.10	1	2.70	4	3.00	1
Damaged water taps	3.60	3	2.90	2	3.10	2	2.70	19	2.50	14	2.90	3
Damage water closets	3.70	1	2.80	3	3.00	4	2.90	7	2.50	14	2.90	3
Defaced of walls with poster	3.10	9	2.50	14	3.00	4	3.10	1	2.70	4	2.90	3
Dampness on toilet wall	3.00	13	3.10	1	3.10	2	3.00	6	2.60	8	2.90	3
Faded paint	3.50	4	2.70	6	2.70	26	2.90	7	2.70	4	2.80	7
Overgrown of green areas	3.00	13	2.40	21	3.00	4	2.80	13	2.80	2	2.80	7
Damaged door and window frames	3.30	5	2.50	14	2.80	16	2.90	7	2.60	8	2.80	7
Cob web in classroom	3.10	9	2.40	21	2.90	8	2.80	13	2.80	2	2.80	7
Cob web in workshop	2.90	16	2.80	3	2.90	8	2.80	13	2.60	8	2.80	7
Damaged door locks	2.90	16	2.60	10	2.80	16	2.80	13	2.30	25	2.70	12
Damage ceiling fans	3.00	13	2.60	10	2.90	8	2.70	19	2.50	14	2.70	12
Burnt and damage fluorescence	2.90	16	2.70	6	2.60	31	2.90	7	2.50	14	2.70	12
Dampness on classroom wall	2.90	16	2.50	14	2.70	26	2.90	7	2.50	14	2.70	12
Failed furniture & fitting	3.30	5	2.50	14	2.90	8	2.70	19	2.50	14	2.70	12
Pipe leakages	3.10	9	2.50	14	3.00	4	2.50	27	2.20	30	2.70	12
Electrical installation	3.10	9	2.40	21	2.80	16	2.70	19	2.60	8	2.70	12
Damage air conditioners	2.90	16	2.10	32	2.80	16	3.10	1	2.50	14	2.70	12
Damage classroom ceiling	2.80	23	2.40	21	2.90	8	3.10	1	2.40	22	2.70	12
Cob web in laboratory	2.80	23	2.60	10	2.80	16	2.60	24	2.60	8	2.70	12
Damaged internal door	2.80	23	2.60	10	2.80	16	2.70	19	2.00	32	2.60	22
Dust accumulation	2.80	23	2.50	14	2.60	31	2.80	13	2.50	14	2.60	22
Deteriorated floor finished	2.90	16	2.30	27	2.70	26	2.50	27	2.70	4	2.60	22
Rough connection of air conditioner duct pipes	3.20	7	2.10	32	2.90	8	2.20	30	2.60	8	2.60	22
Damaged ceiling in offices	2.80	23	2.30	27	2.70	26	2.90	7	2.30	25	2.60	22
Broken windows and damage window railing	2.90	16	2.70	6	2.70	26	2.60	24	2.00	30	2.50	27
Dampness on office wall	2.80	23	2.20	29	2.80	16	2.60	24	2.30	25	2.50	27
Damage class board	2.80	23	2.20	29	2.80	16	2.50	27	2.30	25	2.50	27
Cob web in offices	2.30	35	2.40	21	2.50	33	2.80	13	2.30	25	2.50	27
Damage roof covering	2.60	31	2.50	14	2.80	16	2.20	30	1.90	35	2.40	31
Improper car parking	2.70	30	2.20	29	2.80	16	2.10	33	2.40	22	2.40	31
Un drained water on road/ car parks	2.40	32	2.10	32	2.90	8	1.80	35	2.40	22	2.30	33
Plant grow/algae on wall and roof top	2.40	32	2.40	21	2.50	33	2.00	34	2.20	30	2.30	34
Wall cracks	2.40	32	1.90	35	2.40	35	2.20	30	1.90	34	2.20	35

Note: M- Mean score R- Ranking

From Table 4, the sick building syndromes experienced by users of the Polytechnic campuses were highlighted. In the School of Management and Business Studies (SM & BS), heat and discomfort (3.50) is very significant. The respondents noted that heat and discomfort experienced in other schools of the Polytechnic is significant. According to the survey headaches experienced in the institution is significant in both School of Technology (Sch. Tech), with 3.00 mean score and SM & BS with 2.80 mean score. Also, classrooms' being over crowded has made suffocating complaints significant in SM & BS (2.70) and SES (2.50). Bad furniture's also contributes to the user's complaints of body pains which are significant in

SM & BS (2.50), Sch. of Tech. (2.80), SES (2.70), and SENG (3.10) but less significant in SOA. with 2.20 mean score. In overall, the significant sick building syndromes experience in the Polytechnic were heat and discomfort (3.00), body pains due to bad furniture's (2.70) and headache (2.50). However, heat and discomfort (sig. 0.02) is more synonymous in the learning environment (see Table 4). There are about 18,100

students in Lagos State Polytechnic in an academic year for full time and part time programmes. The climatic condition of Lagos State is hot tropical with high-relative humidity. This is an indication that buildings in the State are exposed to

invariable weather condition such as rain, wind, solar radiation and atmospheric pollution which are all vital agents of maintenance generator. The Polytechnic buildings for SES, SENG, and SST are characterized with frame structures, solid bricks, cement and sand mortar bed and joints. The doors are in timber joinery either flush or panel type, while the windows are of glass and aluminum sliding or projected. SM & BS and SOA are characterized with sandcrete block structure, with cement and sand mortar bed joints. The windows and doors are in glass and aluminum and timber joinery. The floors are mainly finished in PVC tiles, terrazzo and ceramic tiles on screeded bed. The sanitary appliance and fitting are ceramic

wares connected with PVC pressure pipes. The walls of the sandcrete blocks structure were plastered and rendered in cement and sand prepare to emulsion paints where the bricks structure where un-plastered. The buildings are predominately roofed in asbestos or aluminum sheets. Electricity supply by Power Holding Company of Nigeria PLC (PHCN) but due to inconsistent power supply, the Polytechnic provides a standby power generator for each school and other buildings such as ICT centre, administrative, library and so on. Water supply is also generated by the Polytechnic; each school has its water mains.

TABLE III.

SIGNIFICANCE OF BUILDING DEFECT

Defects in School buildings	SM& BS Mean	SENG Mean	SES Mean	SST Mean	SOA Mean	Overall Mean	F	Sig.
Overflow of W.C water	3.70	2.70	2.90	3.10	2.90	3.00	1.83	0.13
Un-drained toilet floor water	3.20	2.80	3.20	3.10	2.70	3.00	0.73	0.58
Damaged water taps	3.60	2.90	3.10	2.70	2.50	2.90	3.04	0.02*
Damage water closets	3.70	2.80	3.00	2.90	2.50	2.90	2.99	0.02*
Defaced of walls with poster	3.10	2.50	3.00	3.10	2.70	2.90	1.22	0.31
Dampness on toilet wall	3.00	3.10	3.10	3.00	2.60	2.90	0.70	0.59
Faded paint	3.50	2.70	2.70	2.90	2.70	2.80	1.58	0.19
Overgrown of green areas	3.00	2.40	3.00	2.80	2.80	2.80	1.21	0.31
Damaged door and window frames	3.30	2.50	2.80	2.90	2.60	2.80	1.19	0.32
Cob web in classroom	3.10	2.40	2.90	2.80	2.80	2.80	1.01	0.41
Cob web in workshop	2.90	2.80	2.90	2.80	2.60	2.80	0.42	0.80
Damaged door locks	2.90	2.60	2.80	2.80	2.30	2.70	1.35	0.26
Damage ceiling fans	3.00	2.60	2.90	2.70	2.50	2.70	0.95	0.43
Burnt and damage fluorescence	2.90	2.70	2.60	2.90	2.50	2.70	0.63	0.64
Dampness on classroom wall	2.90	2.50	2.70	2.90	2.50	2.70	0.85	0.49
Failed furniture & fittings	3.30	2.50	2.90	2.70	2.50	2.70	1.66	0.17
Pipe leakages	3.10	2.50	3.00	2.50	2.20	2.70	2.17	0.08
Electrical installation	3.10	2.40	2.80	2.70	2.60	2.70	1.07	0.38
Damage air conditioners	2.90	2.10	2.80	3.10	2.50	2.70	2.66	0.04*
Damage classroom ceiling	2.80	2.40	2.90	3.10	2.40	2.70	2.07	0.09
Cob web in laboratory	2.80	2.60	2.80	2.60	2.60	2.70	0.28	0.89
Damaged internal door	2.80	2.60	2.80	2.70	2.00	2.60	2.22	0.07
Dust accumulation	2.80	2.50	2.60	2.80	2.50	2.60	0.45	0.77
Deteriorated floor finished	2.90	2.30	2.70	2.50	2.70	2.60	1.04	0.39
Rough connection of air conditioners duct pipes	3.20	2.10	2.90	2.20	2.60	2.60	3.49	0.01*
Damaged ceiling in offices	2.80	2.30	2.70	2.90	2.30	2.60	1.13	0.35
Broken windows and damage window railing	2.90	2.70	2.70	2.60	2.00	2.50	2.58	0.04*
Dampness on office wall	2.80	2.20	2.80	2.60	2.30	2.50	1.60	0.18
Damage class board	2.80	2.20	2.80	2.50	2.30	2.50	1.11	0.36
Cob web in offices	2.30	2.40	2.50	2.80	2.30	2.50	0.75	0.56
Damage roof covering	2.60	2.50	2.80	2.20	1.90	2.40	2.60	0.04*
Improper car parking	2.70	2.20	2.80	2.10	2.40	2.40	2.42	0.05*
Un drained water on road car parks	2.40	2.10	2.90	1.80	2.40	2.30	4.62	0.00*
Plant grow/algae on wall and roof top	2.40	2.40	2.50	2.00	2.20	2.30	0.86	0.49
Wall cracks	2.40	1.90	2.40	2.20	1.90	2.20	1.05	0.39

Three campuses operated by the Polytechnic are located in different district of Lagos State. The maintenance department (works and housing) is located on the main campus in

Ikorodu. Their primary assignment is to monitor, inspect and maintain the diverse disparity facilities of the Polytechnic.

TABLE IV.

<i>Building related illnesses</i>	<i>SM & BS Mean</i>	<i>SENG Mean</i>	<i>SES Mean</i>	<i>SST Mean</i>	<i>SOA Mean</i>	<i>Overall Mean</i>	<i>F</i>	<i>Sig.</i>
Headache	2.80	2.30	2.30	3.00	2.30	2.50	1.43	0.23
Eye pain	2.10	1.90	2.30	1.80	1.70	2.00	1.04	0.39
Cough	2.40	2.10	2.30	2.40	2.00	2.20	0.83	0.51
Dizziness	2.30	2.50	2.40	2.30	2.20	2.40	0.27	0.90
Heat and discomfort	3.50	3.30	2.70	3.20	2.60	3.00	3.14	0.02*
Body pain	2.50	3.10	2.70	2.80	2.20	2.70	1.83	0.13
Cold	2.00	2.30	2.30	2.20	2.30	2.20	0.35	0.84
Suffocating due to overcrowded	2.70	2.40	2.50	2.30	2.30	2.40	0.38	0.82
Running nose or eyes	2.30	2.60	2.30	1.90	2.20	2.20	1.43	0.23
Skin irritation	2.30	1.60	2.20	1.50	2.00	1.90	2.14	0.08
Mental fatigue	1.80	1.90	2.20	2.30	1.60	2.00	1.00	0.41
Reduced memory	1.60	1.70	1.90	1.60	1.60	1.70	0.51	0.73

From the result the school of Business and Management building facilities were in a critical condition this may be due to the age, usage, weather and lack of maintenance. Overstretch of the facilities is caused by the explosion in student's enrolment for commercial programmes. This has a detrimental effect on the users in terms of heat and discomfort, headache and suffocating complaints due to overcrowded. Failed furniture and fitting is also prominent in the school which causes body pain experience by the students and staffs of the Polytechnic. Damaged air conditioners and ceiling fans in offices and classrooms respectively, also causes heat and discomfort to the facilities users. Cough, cold, running nose or eyes and eye pain experience by the respondents maybe due to the damage openings in the buildings which exposed the users to adverse atmospheric condition such as dust, pollution and so on. Skin irritation illness experienced maybe due to mold /algae growth on damp walls especially in the toilets, offices, corridors and some classrooms. Damaged classroom boards, cob webs and dust in the learning spaces can hinder learning process, either the rate of assimilation on the part of the students or the teachers teaching pattern. Pipe leakages are ranked high by the respondents. Often overflow water-closet and pipe leakage caused disruption, frustration and irritation in toilet areas for both students and staffs. The facilities users also measured damaged internal doors and locks as critical. The functional requirement of a door for privacy, protection, safety and security is paramount in the school environment

CONCLUSION

This paper has been concerned with defects in a Polytechnic campus based on user's perception. The identification of critical defects can assist in the maintenance management of the Polytechnic buildings. The level of criticality of the defects will aid the maintenance department in setting priority of the urgency of maintenance need of each

component. Also, dwindled maintenance budget can be effectively allocated and utilized on the bases of maintenance

needs. The study shows that the condition of the facilities in the Polytechnic is appalling. Maintenance of the Polytechnic facilities needs to be addressed on time. That is, prompt attention should be given to the maintenance of identified defects especially the sanitary systems, indoor environment, security and aesthetic issues. Conducive learning environment can only be attained with functional facilities. Campus user's satisfaction depends on the functionality of such facilities provided. The Polytechnic or any educational institution cannot achieve her vision and mission with dysfunctional facilities. Therefore, it is mandatory for any educational institutions to sustain their infrastructural facilities through an effective maintenance system. Hence, defects diagnosis and management is paramount to maintain a sustainable academic built-environment, on which sustainable education is hinged.

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