



ARCHITECTURAL DETERMINANTS OF OCCUPANTS *HEALTH AND HEALTHY LIVING* IN MIXED USE BUILDINGS, LAGOS, NIGERIA

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ABSTRACT

Healthy living is to among other factors determined by ability to make smart health choices such as eating well, being physically active and being emotionally sound. On the other hand, living an unhealthy lifestyle exposes human populations to non-communicable disease which include cancer, heart disease, type 2 diabetes, obesity and early menopause in women among many others. The physical environment people live to a great extent affects the health status of its occupants among many other factors. Hence, the aim of this paper is to identify the architectural features embedded within the physical environment that promote occupants health and their healthy living using mixed use building as case study. To achieve this key objective, a triangulation method was employed as guiding methodology. The first method involves a systematic literature search to identify architectural features which directly or otherwise affect building occupants' health from extant studies and secondly undertook case study approach three case studies to test how effective these architectural features are in promoting health and healthy living. The findings indicated that adequate architectural outcomes such as natural lighting, noise control and ventilation with a mean Likert scale score of Mean- 4.7 were the key architectural design outcomes that promote healthy living, in addition to other design requirements that encourage incidental movements and social connection such as vertical and horizontal walking. However, presence of healing garden with a mean score of Mean-3.64 was found to be the architectural feature with the least impact towards promoting healthy living in mixed-use buildings. By way of conclusion, therefore, professionals in the built environment need to focus on providing design solutions that enhances the functions of human senses (ears, eyes and nose) as well as those elements of design that encourages physical exercises among occupants.

Design outcome, Design elements, Mixed-use building.

1.0 INTRODUCTION

The quality and design of the home as the local environment largely determines the choices made on healthy lifestyle (PHE, 2014). There are a few researches springing up and pointing fingers at the built environment for creating the physical environment to promote unhealthy living. While this assertion is assumed to be true, most part of a persons' day is spent in an interior space created by Architects, there have been however, quite a number of research indicating three major areas in life that the built environment can influence; access to healthy food environment, physical activities and social interaction (Paine & Thompson, 2017; Buettner & Skemp, 2016; England, 2015: Engelen, Dhillon, Chau, Hespe, & Bauman, 2016). Healthy living simply means a way of living that prevents sickness whilst taking a few steps backward from untimely death; this simple but discipline act helps live life hopefully to its fullest and enjoy quality time with friends and family (WHO, Healthy Living, 1999). Creating a healthy environment, requires ability to gear occupants to make healthier life choices like exercising regularly, adequate rest, eating right and interacting with the physical and social environment (Oliffe, et al., 2017). It also needs to efficiently be able to ensure clean air, appropriate density per room area, light, air, thermal comfort, waste management, noise, clean water, and natural ventilation (Ho, et al., 2016).

Keywords: Health, Healthy Living, Architectural

The built environment over time have focused

solely on designing spaces that appreciate the full human senses; to see, touch, feel, smell, and perhaps taste. It has tried to create environments with abundance of clean air, water, sunshine, noise abatement, and appropriate waste disposal (Barton, 2017). However, there are now ranges of disease that are titled the 21st century dilemma which arose across medical studies to be as a result of unhealthy lifestyle which simply has to do with sedentary behaviors such as cancer, cardiovascular diseases, type 2 diabetes (Marreau et al, 2015) and obesity amongst children (Okogba, 2017). The sedentary behaviors simply means being inactive for the better part of the day like using automobiles for the shortest of distances around neighborhoods, sitting extensively to watch television in our homes, excessive sitting in offices, and constant abuse of the use of mobile and smart technologies that are becoming more advanced and more easy to use (Tremblay, et al, 2017). According to Thompson (2014), these negative behaviors can be reduced using appropriate design parameters to provide the necessary requirements that meet the physical, emotional and social needs of a person. The aim of this paper therefore is to highlight this possibility by way of establishing such architectural requirements and features that promote the health and healthy living of residents of mixed use buildings and users by way of measuring their perception.

1.1 Theoretical Framework: architectural determinants of occupant's health and healthy living in mixed used buildings

Architectural features can be found in construction, aesthetics and functionality of a building design. It is seen as the distinctive part and detail of a building. Architectural features differ from one place and time to another. However, it could be the corner of a wall, the wall texture or the floor (Answers.com, 2017). The uniqueness of this building forms the Architectural style and characteristics of a building (Shalunts et al, 2012). The Architectural features associated with healthy living in the house is divided into routes; destinations, activity programme, the building and its surroundings of which nudging people to use this

space, all form of stress should be eliminated (Barnett, et al., 2017; Evans & McCoy, 1998). In general, there are three factors that determine how people will use a space; information, experience and feedback.(Brabers et al, 2015).

The first refers to making spaces that have been created more inviting for use by considering the culture of the people, the behavioral pattern and generally the choices that people make in that locality. The second, however, refers to the skills a person develops as he uses a space. For example, a person will pick a staircase that is more prominent in the building than the hidden one and most likely to also take the shortest route to a destination. The last factor refers to the variety a space creates and the views from that space that will keep people to continue to use it. It is more like receiving a positive response that the space suits their needs.

Moreover, five Architectural dimensions were identified as having direct link to stress and health of building occupants (Evans and McCoy, 1998), which include stimulation of the human senses, affordance in terms of accessibility and the type of spaces provided and control in terms of spatial configuration of spaces. Others include coherence in terms of comprehension and clarity of the spaces and environment, then finally, the possibilities of having restorative a space in other words spaces with therapeutic features. Similarly, a building is considered healthy when it gears its occupants to make healthy life choices like exercising regularly, adequate rest, eating right and interacting with the physical and social environment (Oliffe, et al, 2017). It is also healthy when it's efficiently able to ensure clean air, appropriate density per room area, light, air, thermal comfort, waste management, noise, clean water, and natural ventilation (Ho, et al, 2016). The research done by Bajracharyaa et al, (2015) showed that for a community to be healthy and active, it must be able to foster quality facilities, active transport and connectivity, and mixed-land uses. They also added that the facilities should be provided to allow for variety, accessibility, affordability, and social interaction. Although previous studies

have suggested that nature is the best healer to any form of illness, it however, might not cure it in total but it sure will improve (Totaforti, 2018). Hence, the focus of this paper is to explore the role of Architectural considerations in terms of designs and appropriate use of elements to contribute towards promoting health and healthy living among residents of building or its users.

1.2 Architectural features which affect building occupant's health and healthy living

Numerous studies have indicated architectural features and elements which have direct bearing on building occupants in general. As shown in Table 1, eleven architectural elements of buildings were found by various scholars to have direct link to the promotion or otherwise of occupant's health. In the Table, the first column identified the Architectural elements that have the impact on health and healthy living of occupants. The second and the third columns indicated the criteria in terms of availability in buildings and how the elements affect residents

in promoting their health statuses respectively. The last column shows sources of current works of scholars which focused on the relationship between architectural elements of buildings and health of occupants. For example, a provided and clearly defined building entrance provides its residents with safe and appealing access (Evans & Mccoy, 1998; Afifi, Parke, & Al-Hussein, 2014; Holcombe, 2017). Still, the provision of architectural elements such as corridors, fitness areas, and parks and open spaces provide incentives to residents to walk within and without the buildings thereby achieving physical exercise (Mena et al, 2017; Design, 2006; England, 2015; Vitório, 2013). Other elements of design such as stairs, entrance lobby and walkways among others are known to encourage incidental physical activity among occupants of all age groups (Vitório, 2013; Ho et al, 2016). This paper aims to evaluate the extent to which these Architectural elements are provided and measure perception of users/occupants on how they affect their overall health among selected mixed-use buildings, Lagos, Nigeria.

Table 1.1 Architectural Elements of Buildings and how they affect Resident's Health Status

Arch. Elements	Criteria	How it Promote Heath Status	Scholars
Entrance	Availability of this Element	Providing its Residents' with a safe and Appealing Access	(Evans & Mccoy, 1998) (Afifi, Parke, & AlHussein, 2014), (Holcombe, 2017)
Corridors	Availability of this Element	Incentive to Walk (Exercise)	(Mena, Sepúlveda, Ormazábal, Fuentes, & Palomo, 2017)
Stairs	Availability of this Element	Promote Incidental Physical activity	(Mena, Sepúlveda, Ormazábal, Fuentes, & Palomo, 2017)
Recreational Spaces	Availability of this Element	To incorporate Facilities and Access to a variety of Recreational opportunities for all users	(England, 2015)
Fitness area	Availability of this Element	To promote Physical Activity	(Design T. C., 2006) (England, 2015) (Vitório, 2013)
Sanitary Facilities	Availability of this Element	Promote Sanitation and Cleanliness	(Ibem et al, 2017), (Design T. C., 2006) (England, 2015)
Walkways	Availability of this Element	Creating a Safe and Comfortable Pedestrian Environment for Occupants of all Age's groups	(Herndon, 2011), (Dovey & Pafka, 2017)
Mixed-use	Availability of this Element	Integrate mixed-use (Multiple uses and users)	(Herndon, 2011)
Doors	Availability of this Element	Create Affordance for Usage without limiting any user	(Evans and Mccoy, 1998) (Brabers, Kalis, & Kieverstein, 2015)
Entrance lobby	Availability of this Element	Promote Incidental Physical activity, Walking (Exercise)	(Design T. C., 2006) (Vitório, 2013) (Ho, et al., 2016)
Parks and open Spaces	Availability of this Element	Incorporate a Park or Open space within reasonable Walking Distance to all Users	(England, 2015) (Design T. C., 2006)

1.3 The Case studies

In this paper, three buildings were used as case studies. The first is the 1004 Housing Estate, located along the popular Ozumba Mbadiwe Avenue, Victoria Island, Lagos State, Nigeria. The second and third buildings studied were the South Atlantic Petroleum (SAPETRO) tower which is located on 7, Adeola Odeku Street, and NESTOIL Tower, all in Victoria Island, Lagos. The 1004 is a mixed use building accommodating housing estate and is the thought to be largest high rise estate in Sub Saharan Africa. It comprises of over 1004 flats, maisonettes and studio apartments. It was completed way back in 1979 but later taken over as private partnership entity in 2004. The building is currently a mix of two, three and four bedroom apartments, outdoor sports courts, medium event centres, and swimming pools for both adults and children, effective fire fighting facilities, retail outlets and relaxation outfits. It is also said to have 24 hours electricity, crèche facilities, and children's play area.

Similarly, the second case study, the South Atlantic Petroleum (SAPETRO) tower, houses the offices and residential areas of major oil firms and telecommunication companies in Nigeria. The tower is a twin of thirteen storey office/residential mixed development; it has

about twenty four numbers of 3 bedrooms flats and offices. The office buildings are open office spaces with double glazed state-of-the-art curtain walls external cladding, the residential development are partitioned in concrete block wall. Additional feature is a well-equipped gym. The last building which served as case study is NESTOIL tower also located in Victoria Island Lagos. The building is a mix of residential and commercial spaces, including flexible (open) spaces, and ten premium office apartments. Additional elements in this building include recreational areas, a well-equipped gym and a restaurant. It was provided with multistorey car parking spaces that can accommodate over two hundred cars.

Figures 1-6 shows various architectural elements provided in all the three buildings and which relate to the promotion of healthy living among occupants. For example, the first two Figures (1&2) shows green area (1) and relaxation areas (2) provided in 1004 building respectively while Figures 3& 4 shows resting area in SAPETRO tower (3) provided close to the rooftop and a gymnasium (4) for the use of occupants. Similarly, Figures 5 & 6 shows well lighted entrance lobby (3) and restaurant in which high indoor air quality was achieved (4) in the NESTOIL building.



Figure 1: The green area of the 1004 Apartments, Victoria Island, Lagos State

Source; <https://www.google.com/maps/>



Figure 2: Relaxation of the 1004 Apartments, Victoria Island, Lagos State

Source; <https://www.google.com/maps/>



Figure 3: The resting area close to the rooftop in SAPETRO tower

Source: Author's Fieldwork (January 2019).



Figure 4: The availability of a fitness area in SAPETRO tower

Source: Author's Fieldwork (January 2019).



Figure 5: The entrance lobby of NESTOIL with its characteristic mixture of Natural and artificial lighting. Source: Authors Fieldwork 2018



Figure 6: A restaurant of NESTOIL tower taking into consideration indoor air quality, presence of indoor plants and amazing views to the outside. Source: Authors Fieldwork 2018

2.0 MATERIALS AND METHODS

In this paper, triangulation method of case study and questionnaire survey were used as guiding methodology. According to Johansson (2003) case study is a form of research defined by interest in individual cases, not by the methods of inquiry used. Similarly, according to Yin (2009) case study can be regarded as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context”. The case study here served as the primary research method in order to examine the current status of the selected mixed use building and the extent to which architectural features that enhance healthy living are present in this selected cases. Hence in its simplest form it is a method used to investigate the selected mixed use buildings in Victoria Island, Lagos State.

2.1 Data Collection

The data collection techniques used in the case study include visual survey and scaled drawings of selected 'cases'. Open and close ended questionnaire forms, checklists and photographs of selected cases were also used as the instrument to collect data for the survey. A total of one hundred questionnaires were distributed among occupants of the three cases studies. However, the total number of returned questionnaires were eighty eight (88) representing eighty eight percent (88%) which is considered adequate for analysis. The floor plan analysis of all cases was undertaken to identify and to establish the extent of use of Architectural elements which relate to healthy living among residents of these houses. The extensive literature review carried out was with a view to identify those elements that relates

Architecture to health and healthy living which provided the basis for development of checklist used in the physical survey.

2.2 Data Analysis

A Likert scale of between 1-5 (1-very low and 5-very high) was used with questions to measure the respondent's perception on elements which they thought promote their health and healthy living while in the mixed use building. In addition information on the demographics of respondents were also capture in the questionnaire. The questionnaire responses which relate to demographic information of respondents were summarized and described using percentages commonly available in descriptive statistics. The responses of respondents on roles of architectural elements in the promotion of occupant's health and healthy living were measured and presented using mean values (M) based upon the cumulative responses.

3.0 RESULTS AND DISCUSSION

The first analysis result obtained was the respondents' relevant demographic information. The result is as shown in Table 1. As shown below, three key information were measured due to their relevance to this paper; gender, age group and nationality of respondents. The analyzed data on gender indicated that female respondents were the majority with 56.8% while the male constitutes 43.2% respectively. It also shows that the age group of between 19-26 years was in the majority with 29 respondents or 33%. Nigerians who constituted respondents were in the majority with above 90% while other nationalities were only 9.1%.

Demographic Information	Demography	Percentage (%)
1. Gender	Male	43.2
	Female	56.8
2. Age group	19-26	33
	26-30	31.8
	31-35	14.8
	36-40	4.5
	41-45	9.1
	45-50	2.3
	50 and above	4.5
3. Nationality	Nigerian	90.9
	Others	9.1

(Source: Authors Fieldwork, December 2018)

Our attempt to measure the results on respondents' health status before and after living in the mixed use building however indicated that majority felt that they were in better condition of health after moving into the mixed use building. As shown in Table 2, a total number of twenty respondents rated their health as very good after moving into mixed use building when compared

with 14 respondents (44.7%) when they lived in single use house and gave the same rating. However, 15 respondents (36.6%) believed that their health was 'good' in single use building as against 11 (23.4%) who claimed the same health condition when they moved to mixed-use buildings.

Table 3.2: Cross Tabulation between Single Use/Mixed-Use and Effect on Occupant's Health Status.

		Average	Good	Poor	Very good	Total
Single use or Mixed-use	Single use	8 19.5%	15 36.6%	4 9.8%	14 34.1%	41 100.0%
	Mixed-use	11 23.4%	11 23.4%	4 8.5%	21 44.7%	47 100.0%
Total		19 21.3%	26 29.2%	8 9.0%	36 40.3%	88 100.0%

(Source: Authors Fieldwork, December, 2018)

The last analysis was undertaken to determine the level of contribution the individual architectural elements made towards occupants health and healthy living in the mixed use buildings. The perception of the building occupants was measured and the result is as shown in Table 3, the perception of occupants who served as respondents was measured based on twenty six Architectural elements found available in the three case studies and other design outcomes, which affect health and their

healthy being in the building. The overall Mean scores of all elements given by respondents were all above average indicating that respondents attach importance to all the elements. However, among the twenty six Architectural elements and design outcomes, the indoor air quality which cover the level of achieved daylight, noise control and ventilation scored the highest *Mean* of 4.70 followed by Accessibility to communal facilities and availability of children play area with *Mean* scores of 4.49 and 4.47 respectively.

However, availability of healing gardens had the least *Mean* value of 3.64 indicating that the respondents were of the opinion that the presence of this element had no effect on their health and healthy living in the mixed use building. The healing garden was followed by roof garden (*Mean*-3.65) and organic food store (*Mean*-3.80).

Hence, for the occupants of these buildings, the Architectural design outcome which provides adequate daylighting, noise control and ventilation is most important to the occupants' concerning their healthy living. This is in line with the study on health and hygiene done by (Ho et al, 2016; Barton, 2017) and many others as reviewed from literature.

Also, the presence of Architectural elements such

as roof garden, healing gardens were not considered as important by the occupants towards their healthy living as emphasized by the following scholars (Mena et al, 2017; Design, 2006; England, 2015; Vitória, 2013).

A significant aspect of this result shows that Architectural elements which encourage walking as form of exercise scored mean scores of above 4.0. For example, Places for social events interaction (*Mean*-4.08), aesthetically street design for walking and biking (*Mean*-4.18) and Recreational areas (*Mean*-4.31) indicating key roles in promoting healthy living which is in agreement to the studies of the following scholars (Paine & Thompson, 2017; Buettner & Skemp, 2016; England, 2015: Engelen, Dhillon, Chau, Hespe, & Bauman, 2016).

Table 3.3: Residents Perception on Effect of Measured Architectural Elements and Design Outcomes on their Health and Healthy Living in the Studied Mixed Use Building.

Descriptive Statistics				
	N	Minimum	Maximum	Mean
Daylight, noise control and ventilation (Indoor Air Quality)	88	3	5	4.70
Accessibility to communal facilities	88	2	5	4.49
Children play area	88	2	5	4.47
Clinic pharmacy	88	2	5	4.42
Design for all age groups	88	1	5	4.41
Access to health food stores	88	2	5	4.35
Recreational areas	88	2	5	4.31
Aesthetically street design for walking and biking	88	2	5	4.18
Multifunctional open spaces	88	2	5	4.12
Balconies	88	1	5	4.11
Places for social events interaction	88	2	5	4.08
Community garden	88	2	5	4.06
Fitness center	88	1	5	3.99
Views of the sky, city and landscape from building	88	2	5	3.98
Home gym	88	2	5	3.94
Courtyard for relaxation	88	2	5	3.93
Organic food store	88	1	5	3.80
Roof garden	88	1	5	3.65
Healing gardens	88	1	5	3.64
Valid N (listwise)	88			82.94

(Source: Authors Fieldwork December, 2018)

4.0 Conclusion

Finally, this research was not trailing on the path of perfection but a step forward to redirecting the true purpose of designing buildings, which does not only improve productivity but also help enhance the healthy living of occupants

The results is not surprising at all, as it has already been established in extant literature in both Architecture and Medical spheres that design outcomes such as provision of optimum daylight, ventilation and noise control in enclosures helps reduce occupants stress within an environment in turn enhancing health.

However, occupant did not feel the need for spaces like healing gardens, roof gardens and open recreational spaces as this are not regularly enforced in the design process of this building typology asides from health centres. The fact that the professionals know better that the home is the fortress of the body should go ahead to nudge occupants, to every Architectural element that is beneficiary as reviewed.

The implication of these findings in Architectural terms therefore lies in the importance of specifying openings, glazing type and materials for enhanced natural daylight, acoustics elements and orientation of windows, vents and other openings for enhanced natural ventilation.

Also, mixed-use buildings will be checked on approval to ensure that the design solutions it's providing enhances the human senses (ears, eyes and nose) as well as those elements of design that encourages healthy living among occupants.

6.0 References

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