

Study of the Users Satisfaction with Natural Lighting and Ventilation in State Library Gombe, Nigeria

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ABSTRACT

Natural lighting and ventilation is desired in public libraries for efficient lighting, human comfort and structural cooling. The study revealed that public libraries in Gombe could not function efficiently without artificial source of ventilation and lighting, which is economically a disadvantage, unreliable and has sustainability problems. However natural lighting and ventilation when harnessed is more efficient and more reliable and consume less energy when compared with other source of lighting and ventilation. This research focuses on the evaluation of application of natural lighting and ventilation in public library in Gombe state with a view to solve poor level of natural lighting and ventilation, conducted through observation schedule of variables such as structure survey through questioners on the present Gombe state library. Seven categories of users were selected based on the composition of the library use and extracted four components of satisfaction. The study reveals that users are not satisfied with the current condition of lighting and ventilation and to add to others facilities that would make the building effective. The study also shows that only 45% of users often use the library in a week, 90% of users identified the necessity of public library, 10% was rated for effectiveness of lighting and ventilation and 10% for facilities. The study recommends professional in the built environment to approach projects holistically with the psychology of attaining functionality more to aesthetics and to consider users perception towards utilization. Nigerian public library requires better design to attract cooling and human comfort, reduce energy consumption, such to make the building attractive to users.

Keywords: cooling, Gombe state, human comfort, natural lighting and ventilation, public library

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INTRODUCTION

According to concise Oxford dictionary, (Tenth edition, 2008) [1] a library is a building or room containing a collection of books and periodicals for use by the public or members of an institution. Public libraries offer their collections and services to all members of the community. The libraries range in size from one-room

facilities in sparsely populated rural areas to large multi-branch systems that serve millions of people in urban areas [2]. Urban public library systems generally maintain a large central library in a downtown areas as well as several smaller branches-known as neighborhood or community libraries in the various neighborhood of the city. Some public

libraries provide services to rural areas of the communities with book mobiles, which are trucks, trailers, vans, or buses equipped to serve as travelling lending libraries [2].

Gombe State was created in October, 1996 from old Bauchi State. It is made up of 11 Local Governments, with a total population of 2,448,236 [3]. It has about 386 secondary schools, 8 higher institutions, 18 state ministries, 32 state organization and parastatals, 49 Federal parastatals, 16 banks, 9 development partners, 2 companies and many hospitals, Wikipedia (2014) [3]. In the past 5 years, Gombe state has witnessed a lot of changes; Ministry of information (2009) [4] pointed out that “the state became a beehive of various development activities and initiatives that are transforming not only the physical structures and vital infrastructure but also the socio-economic institutions of the state”.

Attempt to develop and establish libraries in Gombe started when Gombe State Library Board was formed after the creation of the state. The function of the Board was to facilitate the function of the existing library board law; to provide and maintain efficient library services for the public in the state, to establish, equip and maintain the library in the state capital and where possible open more branches in the state, to staff and supervise primary and post primary school libraries in the state and to supervise and help organize library services in ministries and departments in the state.

It is unfortunate that these laws have not been impacted in the state as expected because of the absence of standard public library. Even though a national library is under construction, the existing state library is not properly in use because of the absence of quality services and poor condition of the building. More so we are

in an information age and the changes in the state are demanding that the government should synchronize information and knowledge to make Gombe state citizens information literate so that they can contribute, appreciate and be carried along in the wave of the development of the state. The contributions libraries and information centers can make to the key societal challenges cannot be overemphasized. An evolving society like Gombe state has so much to benefit from public library, in promoting greater social cohesion and a stronger sense of civic pride and local identity.

LITERATURE REVIEW

Public libraries serve communities of all sizes and types. As the name implies, public libraries serve the general public, “from cradle to grave” as more than one public librarian has been heard to say. Public libraries often have departments that focus on areas of services, such as youths, teens and adults [5]. Every community as a matter of necessity needs a public library. They provide communities with a wide choice of literature that is more general and other information media than the academic libraries.

Good natural ventilation is an important factor in every library, both public and institutional. This is necessary for adequate reading and learning to take place in the library. Therefore, effective placement and position of window openings for proper natural ventilation in the libraries are necessary in the design of libraries. In other words, it is important to keep an eye on the air quality of inside the library where the library users spend most of their time searching for information. This effort would facilitate the users understanding of their studies or research [6].

Table 1. Effective depth to building height.

Strategy	Floor to Ceiling Height
Single sided, single opening	2 x floor to ceiling height
Single sided, double opening	2.5 x floor to ceiling height
Cross ventilation	5 x floor to ceiling height
Stack ventilation	5 x floor to ceiling height
Atria	10 x floor to ceiling if centrally located

(CIBSE, 2005).

Building form is very important strategy to be considered in designing naturally ventilated buildings. Buildings that rely on natural ventilation should have a narrow plan. This is because it is very difficult to ventilate a very wide space using natural ventilation; the maximum depth that one could ventilate using natural ventilation is 15 m. Also, for natural ventilation adequate floor ceiling height of at least 2.7 m is required [7]. Table 1 identifies effective depth to building height if natural ventilation is considered in buildings.

The use of external structural shading devices is also an important strategy in designing naturally ventilated buildings. The external shading devices are used to deflect solar radiation thereby reducing solar heat gains and as such increase the chances of natural ventilation as well as cooling building interior spaces [7]. Natural ventilation in buildings can be achieved through stack or buoyancy driven ventilation. The stack effect refers to the movement of air as result of differences in air pressure of two bodies of air at difference temperature. Thus, when there is a significant difference in the temperature of air within the outside of a building possessing appropriate air inlets and outlets, air movement results to cooling effect [8]. The cooling produced by stack effect can be increased by better design of openings. Inlets should be on the windward side of the buildings with outlets on the leeward side. The difference in height between inlet and outlet should be maximized [9]. Other natural

ventilation revolves around wind driven ventilation. Wind pressure is the major force responsible for air flow through buildings. When the wind strikes a building, it is slowed down but at the same time it exerts a pressure on the building. The pressure exerted is directly proportional to the wind velocity [10].

STUDY AREA

Gombe state, nicknamed the *Jewel of Excellence*, was formed in October 1996 from part of the old Bauchi state by the Abacha military government. Being it located in the north eastern zone, right within the expansive savannah allows the state to share common borders with the states of Borno, Yobe, Taraba, Adamawa and Bauchi. The state has an area of 20,265 km square and a population of around 2,353,000 people [11]. Gombe state has two distinct climates, the dry season (November to March) and the rainy season (April to October) with an average rainfall of 850 mm. The state is headed by the Executive Governor Inuwa Yahaya and also has 24 State House Assembly members. The state has 11 Local Government Area and 14 Emirates/Chiefdoms, 3 senators and 6 Members in the National Assembly [12]. Education is given priority in the state and many primary and secondary schools, colleges of education, and an Arabic Teacher's College has been established to provide the people with quality education [13].

Throughout the month of December, day time temperatures will generally reach highs of around 30°C that's about 86°F. At night the average minimum temperature drops down to around 12°C, that's 53°F. In recent times the highest recorded temperatures in December has been 4°C, about 39°F. The average daily relative humidity for December is around 29%. The heat index is a measure of how hot it feels when relative humidity is added to

actual air temperature. From this, a comfort level is calculated providing categories on how heat conditions might adversely affect someone [14]. The average monthly amount of precipitation has been recorded around 0 mm, that's 0 inches. The average daily wind speed in December has been around 5 km/h, that's the equivalent to about 3 mph, or 3 knots. In recent years the maximum sustained wind speed has reached 89 km/h, that's the equivalent of around 55 mph, or 48 knots [14].

The topography of Gombe town is undulating area that is susceptible to high erosion. The soil is characterized by stony texture and cracking clay. It is generally described as "Black clay vertisole" derived from shale with some sandy loam which constitutes the soil type of the area. The state falls within the Sudan savannah zones characterized by mixed combretaceous wood land and abundant long grasses of about 1.5–2 m high. Common also are *Acacia* spp., the shea-butter, Baobab and silk cotton trees with few stunted trees hardly 1.5 m high. This could be attributed to longer and severe dry season [15]. The radiation rate of about 80–84% net energy is used as latent heat of evaporation during the rainy season, thus day time temperature are fairly constant. Night temperatures are fairly low due to cloud cover and absence of black radiation. During the dry season however, when there is little water for evaporation and transpiration, the bulk (net energy) is used in heating the air. The highest wind speed measure in nautical miles of 140 is usually in May and the shortest speed of 22.50 is experienced in November [15].

The climate in Gombe state belongs to the warm humid region, generally dominated by a wind direction which is principally from south-west. This prevails for about three

quarter of the year while the north-east wind blows for the remaining quarter. The former blows across the Atlantic with a high moisture content while the later is dry and dusty from the hinterland. It is also characterized by heavy rain fall and the solar radiation is partly reflected and partly diffused with an air temperature between 27°–35° during the day 21°–27° at night [15].

METHODOLOGY

The study conducted evaluation of application of natural lighting and ventilation in public library in Gombe through physical observation; visit of the existing library and careful observation of its features, guided tour around the building and its facilities, structural survey through questioners on library needs, uses, administration, and other comfort parameters. Seven categories of users were selected based on the composition of the library use and extracted four components of satisfaction.

PRESENTATION OF DATA AND DISCUSSION OF RESULT

Table 2 captured the various responds from seven correspondent users of Gombe state library. The various outcomes of seven users identify the paramount need to have a state library in the state. The library was identified to have inadequate lighting and ventilation and in effective facilities. Such factors are very important elements to make the library function in full capacity but because of the serious lacking, users find it difficult to make optimal use.

Results from Table 3 identifies the fairly use of the library which stands at 45% is reflected by the discomfort caused through the inadequate lighting and ventilation present in the building. The poor design associated to the library building does not even warrant the accommodation of standard facilities. Nevertheless, the

citizens necessitated the 90% need of a standard library to boost optimal use and

to meet up the 21st century millennium goal of access to information and learning.

Table 2. Structured user interview for the present Gombe State Library.

USER 1			
1. SEX: M 2. AGE: 40 3. EDUCATION QUALIFICATION: First Degree			
A.	How often do you use the library in a week?	1 2 3 4 5 6	
B.	Is there need for state library in Gombe?	Yes No	
C.	How conducive (lighting and ventilation) is this library	Adequate In adequate	
D.	How do you rate this library in terms of facilities	Effective In effective	
USER 2			
2. SEX: F 2. AGE: 28 3. EDUCATION QUALIFICATION: First Degree			
A.	How often do you use the library in a week?	1 2 3 4 5 6	
B.	Is there need for state library in Gombe?	Yes No	
C.	How conducive (lighting and ventilation) is the library	Adequate In adequate	
D.	How do you rate this library in terms of facilities	Effective In effective	
USER 3			
3. SEX: M 2. AGE: 13 3. EDUCATION QUALIFICATION: Secondary School			
A.	How often do you use the library in a week?	1 2 3 4 5 6	
B.	Is there need for state library in Gombe?	Yes No	
C.	How conducive (lighting and ventilation) is the library	Adequate In adequate	
D.	How do you rate this library in terms of facilities	Effective In effective	
USER 4			
4. SEX: F 2. AGE: 14 3. EDUCATION QUALIFICATION: Secondary School			
A.	How often do you use the library in a week?	1 2 3 4 5 6	
B.	Is there need for state library in Gombe?	Yes No	
C.	How conducive (lighting and ventilation) is the library	Adequate In adequate	
D.	How do you rate this library in terms of facilities	Effective In effective	
USER 5			
5. SEX: M 2. AGE: 7 3. EDUCATION QUALIFICATION: Primary School			
A.	How often do you use the library in a week?	1 2 3 4 5 6	
B.	Is there need for state library in Gombe?	Yes No	
C.	How conducive (lighting and ventilation) is the library	Adequate In adequate	
D.	How do you rate this library in terms of facilities	Effective In effective	
USER 6			
6. SEX: F 2. AGE: 7 3. EDUCATION QUALIFICATION: Primary School			
A.	How often do you use the library in a week?	1 2 3 4 5 6	
B.	Is there need for state library in Gombe?	Yes No	
C.	How conducive (lighting and ventilation) is the library	Adequate In adequate	
D.	How do you rate this library in terms of facilities	Effective In effective	
USER 7			
7. SEX: M 2. AGE: 47 3. EDUCATION QUALIFICATION: Library staff			
A.	How often do you use the library in a week?	1 2 3 4 5 6	
B.	Is there need for state library in Gombe?	Yes No	
C.	How conducive (lighting and ventilation) is the library	Adequate In adequate	
D.	How do you rate this library in terms of facilities	Effective In effective	

Source: Authors' Survey, 2020

Table 3. Summary of structural interview carried out in existing Gombe State Library.

Questions	Percentage	Remark
A. How often do you use the library in a week?	45%	Fairly attended
B. Is there need for state library in Gombe?	90%	Strongly agreed
C. How conducive (lighting and ventilation) is the library	10%	Discomfort
D. How do you rate this library in terms of facilities	10%	Poorly designed

Source: Authors' Survey, 2020

Table 4. Summary results from questionnaire administered in the existing Gombe State Library to determine the effectiveness or otherwise of the library.

A.	How often do you use the library in a week?	Frequent	Not frequent	Total
	No. of Respondents	40	12	52
	Percentage of Respondents	76.9%	23.07%	100%
B.	Is there need for state library in Gombe?	Yes	No	Total
	No. of Respondents	48	4	52
	Percentage of Respondents	92.30%	7.69%	100%
C.	How conducive (lighting and ventilation) is this library	Effective	In effective	Total
	No. of Respondents	15	37	52
	Percentage of Respondents	28.84%	71.0%	100%
D.	How do you rate the library in term of facilities	Adequate	In adequate	Total
	No. of Respondents	4	48	52
	Percentage of Respondents	28.84%	92.30%	100%
E.	Is the library properly located?	Yes	No	Total
	No. of Respondents	17	35	52
	Percentage of Respondents	67.3%	32.6%	100%
F.	How conducive in term of Landscape is the library?	Adequate	In adequate	Total
	No. of Respondents	5	47	52
	Percentage of Respondents	9.6%	90.3%	100%

Source: Authors' Survey, 2020

Table 4 shows that 70–80% of the respondents are of the opinion that the existing state library:

- Is not properly ventilated and lit
- Is not properly located
- It has no feature of landscape
- The facilities are grossly inadequate
- There is need for a befitting library complex in the state capital.

RECOMMENDATION

Gombe state requires a befitting public library that would be properly located, ventilated and lightened, well landscaped and equipped with standard facilities that would meet the present demand of users. Professionals in the built environment should integrate users' perception on designs in order to have optimal utilization of public libraries.

Good natural lighting and ventilation is an important factor in every library. Sky lights in library design enhance natural lighting and narrow plans and courtyard optimizes natural ventilation. The needs for architects to consider building form when designing a library is an important strategy to be considered in designing natural ventilated buildings. Effective

placement and positioning of window openings for proper natural ventilation in the libraries are necessary in the designs of libraries.

It is important to consider the air quality of inside the library where the library users spends most of their time searching for information. For hot climate like Gombe requires a library design with external shading devices to deflect solar radiation thereby reducing solar heat gains and increasing chances of cooling the library interior. Enforcement of CIBSE, 2005 regulation of effective depth to building height would add to the effectiveness of natural lighting and ventilation in Gombe state library [7].

CONCLUSION

Good planning and design can create libraries with a sense of tradition as well as a place where information is available at users' fingertips. The need for a better designed library is identified paramount to the development of the state. Natural lighting and ventilation plays a vital role in every public library such to say, the comfort of the occupants determines the number of hours to stay in and search for

information and participate in other activities associated with the library.

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