
The Influence of Library Building Features on Indoor Daylight Quality of Reading Spaces Under Overcast Sky Conditions

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ABSTRACT

Building design features contribute to the performance of indoor daylight quality. Reading spaces in library buildings require effective daylighting for good learning processes and energy savings. This study investigated the indoor daylight quality of the six reading spaces labelled Esut-Hall A, Esut-Hall B, Esut-Hall C, Esut-Hall D, Esut-Hall E, and Esut-Hall F. It determined the influence of individual building design features on daylight quality. The study adopted case study research, combined with an HS1010 light metre experiment. The first result identified twenty-five building design features that influenced the daylight quality. The second result indicated that the illuminance values of Esut Hall A, Esut-Hall B, Esut-Hall D, Esut-Hall E, and Esut Hall F are within the recommended range of 300 lux and 500 lux. Only Esut-Hall C is below the range. The identified design features showed that some of the windows in Esut-Hall C were ineffective due to some internal wall obstructions. Therefore, it was recommended that the effective windows' area be increased, and top-light windows be introduced.

1.0 BACKGROUND

The performance of indoor daylighting depends on building design features such as geometry, material properties, orientation, glazing, shading, positioning, sun tunnel, climate, latitude, obstruction, and reflection (Velux, 2014). The indoor daylighting of reading spaces relies on these features. The reading spaces in the library are utilised by academicians and non-academicians of the university as well as other research workers, and alumni outside the university (2018). The task of reading is the most important in the library, and it requires effective lighting. According to Malman (2005), proper lighting is very necessary for the overall success of any type of library. Edward (2005) stated that a remarkable library reading space should be characterised by volumes and surfaces illuminated with glare-free daylight. Good daylight quality has been associated with so many benefits, such as an improved learning process; enhanced mood and morale, reduced eyestrain; and energy savings (Mardaljevic et al., 2012), among others. Daylight and the spatial qualities of library reading spaces have profound effects on user behaviour and productivity (Raihaneh & Halil, 2018). Several other studies in buildings have recorded the energy savings for electric lighting from using daylight to be in the range of 20% and 60% (Galasiu et al., 2007) and range of 16% and 20% (Mardaljevic, Andersen, Roy & Christoffersen, 2012). Gregg (2016) also made it clear that the benefits of a daylit building extend beyond simple energy savings but also reduce greenhouse gas emissions and slow fossil fuel depletion. A study done by Veitch (2003) has shown that daylighted interior spaces result in more effective learning in libraries, schools, and workspaces. And also, daylight should be the primary light source inside buildings for the sake of human health and well-being. Visual observation indicates that the library reading spaces that are under investigation use artificial lighting as the primary source of light, even though there are so many architectural features for daylighting in their design. University library spaces where most students and others spend time reading should be comfortable and satisfying for increased learning and productivity. As such, the quality of daylight in university libraries should be assessed and compared with the recommended global standard. According to the Illuminating Engineering Society of North America (IESNA, 2013) and EN 12464-1(2021), the recommended required daylight level for library reading and studying areas is measured by identifying the illuminance level which should be between 300 lux and 500 lux. According to Velux (2014), the illuminance level of an interior space is the measure of the amount of light received on the surface, and it can be measured with a lux meter, or predicted through the use of computer simulations with recognized and validated software. Illuminance is the measure of light currently used by most performance indicators to determine daylight availability in interior spaces.

However, interest in investigating the daylight quality of this library arose because of its location in the tropics. It is one of the major public university libraries located in Nigeria (tropical region). In this region, daylight availability is considered to be high and available throughout the year (weatherspark 2023). Despite the abundance of sunlight, research has shown that daylight levels in interior spaces are grossly inadequate, inconsistent, and sometimes with glare possibility (Ayoosu et al., 2020). Research has also shown that there has been a prevalent problem of severe electric shortages due to a non-steady power supply (Darling, Hoyt, Murao, and Ross, 2008). Therefore, if library reading spaces use electricity as the primary source of light, which is not consistent, then there is a need to investigate the indoor daylight quality of its reading spaces and to identify the impact of its building design features on the daylight quality. This study investigated the illuminance level of the six reading spaces under overcast sky conditions in tropical climates and determined the influence of building design features on daylight quality. The overcast sky condition shows the cloudiest sky, in which the cloud coverage is greater than 95%.

2.0 THE STUDY AREA



Figure 1. The aerial view of the library building.
Source: Google Earth 2024.

The library building is the major library in a public university located in the hot, humid southeast zone of Nigeria. It lies on the 601811611 North and 703211711 East of the Greenwich Meridian covering an area of 3064 m² at a perimeter of 358.51 m as shown in Figure 1. The building has an orientation of 30 N-W.

The building housed six reading spaces with offices, administration areas, and some open spaces. The six reading spaces under study are labelled Esut-Hall A (social science section), Esut-Hall B (humanities section), Esut-Hall C (reference section), Esut-Hall D (science and technology/serial section), Esut-Hall E (digital section 1), and Esut-Hall F (digital section 2). The parts where the reading spaces are located are labelled in Figure 2. The remaining spaces were the offices, walkways, entrance porch, and toilets among others.

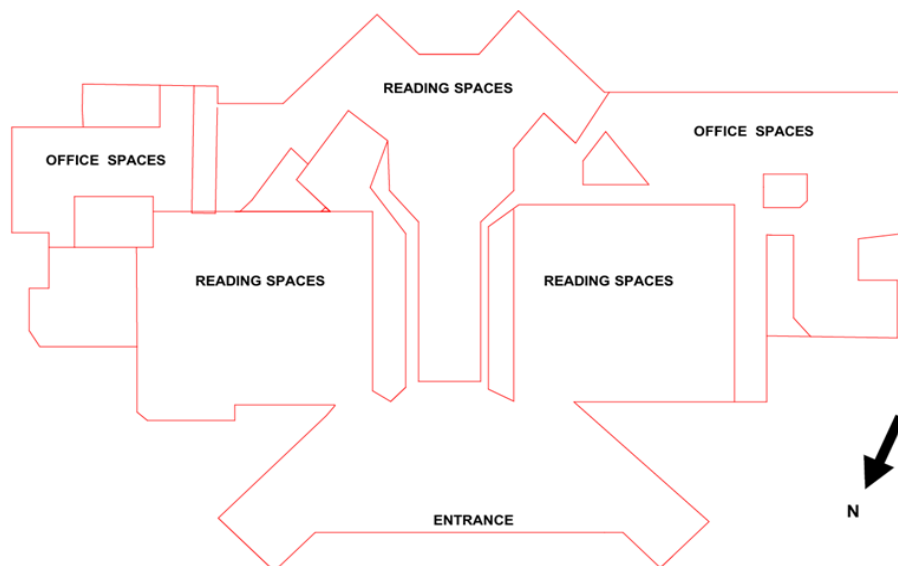


Figure 2: The plan view of the library building, indicating the reading spaces' positions.
 (add source)

In the study area, the wet season is known for its warm, resilient, and overcast nature, while the dry season is known for its hot, humid, and partly cloudy nature. The study area has three prevalent sky conditions. They are clear, intermediate, and overcast sky. This is summarised in Table 1. below with the percentage of time spent:

Table 1. The percentage of time spent in each cloud cover band. Source: Weather Spark (2024).

Fraction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cloudier sky	58 %	68%	79%	83%	85%	79%	78%	80%	81%	82%	70%	54%
Clearer sky	42 %	32%	21%	17%	15%	21%	22%	20%	19%	18%	30%	46%

Table 1. shows that the clearest sky condition was observed in the December period at a rate of 46%, while the cloudiest sky condition was observed in the May period at the rate of 85%. Therefore, to investigate the illuminance level of the six reading spaces under overcast sky conditions, the research was carried out in May.

3.0 METHODOLOGY

The study adopted case study research in combination with experiments to measure the values of the illuminance to determine the indoor daylight quality of the selected reading spaces. The methods involved on-site measurements and observation. Experiments were performed using an HS1010 light meter to determine the illuminance level. The experiment was performed on six reading spaces labeled Esut-Hall A, Esut-Hall B, Esut-Hall C, Esut-Hall D, Esut-Hall E, and Esut-Hall F. The study considered the following building design features: space geometry, location, space floor level, fenestration, window types, window locations, glazing transmittance, shading devices, wall finish, wall colour, furniture provided, furniture arrangement, height of furniture, door type, floor finish, ceiling material, obstructions, headroom, window sill level, window dimensions, number of windows, area of window, window wall ratio (WWR) and window floor ratio (WFR). For the experiment, the first reading space was divided into nine (9) locations or sensor points. The division was done in such a way that more than 80% of the reading hall was covered. Nine (9) H1010 light meters were placed at those sensor points at the work plane of 850 mm (since the height of the reading desk is 750mm). The field measurement was conducted in May during the cloudiest period (overcast) of the year. The electric light was turned off, and measurements were taken at every 15-minute interval, holding it for 10s to obtain a stable illuminance reading. This was carried out from 8 am to 4 pm during the reading hours in the library. The mean values were calculated for every 1 hour (8 a.m., 9 a.m., 10 a.m., 11 a.m., 12 p.m., 1 p.m., 2 p.m., 3 p.m., and 4 p.m.). Hourly daylight illuminances at work plane height across the ground floor were normally predicted using the rigorously validated daylight coefficient technique as presented by Mardaljevic (2000). The experiment was carried out in the same way on the subsequent days for the remaining five reading spaces.

3.1. Sample Selection

The selection was done to obtain the reading spaces that will represent others for the experiment. The experiment was used to obtain the illuminance level, and its average was compared with the recommended global standard (range of 300 lux to 500 lux). However, there is a strong direct relationship that exists between Window-Floor-Ratio (WFR) and daylight illumination levels (Nabil A. & Mardeljevic, 2005). Therefore, the Window-Floor-Ratio (WFR) was chosen as a reliable factor among the architectural features to consider in determining the sample size. Using stratified random sampling, five distinct groups of window-floor ratio percentages were created for selection basis. And one reading space was selected randomly from each group. They are, 1% - 9% (very low), 10 % - 14% (low), 15% - 19% (slightly moderate), 20% - 25% (moderate) and 26% - above (high). Three of the reading spaces written in red in Table 2. were chosen, they are Esut-Hall A for all the 26% and above, Esut-Hall C for 15%-19%, and Esut-Hall F for all the 1% - 9%.

Table 2. Reading Spaces with their WFR (%).

S/N	READING AREAS	WFR (%)	GROUPS
1.	ESUT-HALL A	35	26% - above (high).
2.	ESUT-HALL B	35	26% - above (high).
3.	ESUT-HALL C	15	15% - 19% (slightly moderate)
4.	ESUT-HALL D	26	26% - above (high).
5.	ESUT-HALL E	8	1% - 9% (very low)
6.	ESUT-HALL F	8	1% - 9% (very low)

These three reading spaces were used to experiment to determine their illuminance levels and their architectural features were equally described.

4.0 DATA PRESENTATION AND ANALYSIS

Data on the various architectural daylight features and conditions were sourced from personal observations and measurements, while illuminance readings were obtained from the light meter.

4.1. Architectural Design Features of the Reading Spaces

The six reading spaces of the major library are presented in Tables 3 and 4 which illustrate their different architectural features. Table 3 shows the three reading spaces that are located on the ground floor. Figure 3 below shows the positioning and location of the three reading spaces on the ground floor.

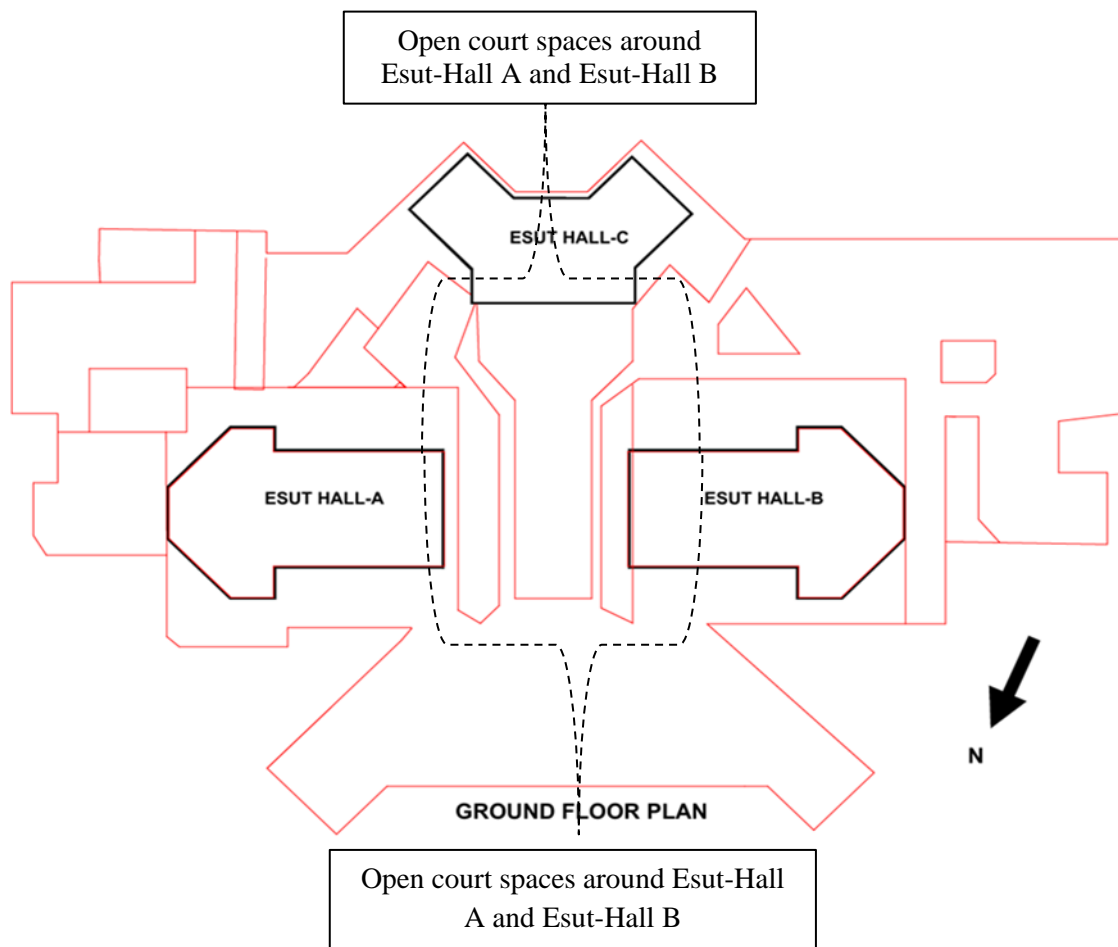


Figure 3. The reading spaces are located on the ground floor.
(add source/reference)

The building design features are twenty-five in number and are summarized in Table 3.

Table 3. Summary of the building design features of the six reading spaces. Source: Author's field work

READING SPACES – GROUND FLOOR				
S/ No	ARCHITECTURAL DESIGN FEATURES	Hall A (Social Science section)	Hall B (Humanities section)	Hall C (Reference section)
1.	Space Geometry	Decagon	Decagon	Decagon
2.	Location	Front	Front	Rear
3.	Space Floor Level	Ground Floor	Ground floor	Ground floor
4.	Fenestration	Side- lighting	Side- lighting	Side-lighting
5.	Type of windows used	Projected glazed/ aluminium	Projected glazed/ aluminium	Projected glazed/ aluminium
6.	Locaton of windows	Three sides	Three sides	Four sides
7.	Glazing transmittance	6 mm single clear (0.89 visible transmission).	6 mm single clear	6 mm single clear
8.	Shading devices	None	None	None
9.	Wall Finishing	Painted	Painted	Painted
10.	Wall color	Creame	Creame	Creame
11.	Furnitures provided	Tables /chairs / shelves	Reading table/ chairs/shelves	Reading table/ chairs/shelves
12.	Furniture arrangement	Four-seating	Four- seating	Eight- seating
13.	Height of furniture Shelves - Tables -	2.25 m 0.75 m	2.25 m 0.75 m	2.25 m 0.75 m
14.	Type of door	Opened from lobby	Opened from lobby	Metal Panelled
15.	Floor finish	Ceramic tiles	Ceramic tiles	Ceramic tiles
16.	Ceiling material	White painted slab	White painted slab	PVC strips
17.	Source of obstruction	Building wing / shelves arrangement/ burglary proof	Building wing / shelves arrangement/ burglary proof	From the interior windows located on the corridor
18.	Height	3.5 m	3.5 m	3.2 m
19.	Window sill level	1.3 m (4 nos), 0.8m (9 nos)	1.3 m (4 nos), 0.8m (9 nos)	1 m (6 nos), 0.45m (2 nos)
20.	Window widths – Window height -	0.82 m – 3.9 m 2.2 m (4 nos), 2 m (9 nos)	0.82 m – 3.9 m 2.2 m (4 nos), 2 m (9 nos)	1.48 m- 3 m 1.2 m(4 nos), 2m(2 nos), 2.4 m(2 nos)
19.	Floor area	296.4 m ²	296.4 m ²	216.8 m ²
20.	Wall area (no openings) – Wall area -	194.6 m ² 92.3 m ²	194.6 m ² 92.3 m ²	184.6 m ² 151.6 m ²
21.	Number of windows	13	13	8
22.	Windows total area	102.3 m ²	102.3 m ²	33 m ²
23.	Window – Wall –Ratio	53 %	53 %	17 %
24.	Window – Floor – Ratio	35 %	35 %	15 %
25.	Main source of light	Daylight and electricity	Daylight and electricity	Daylight and electricity

Table 4 shows the three reading spaces with one located on the first floor, and the other two located at the second floor. Figure 4 below shows the positioning and location of the one reading spaces on the first floor, while Figure 5 shows the positioning and location of the two reading spaces on the second floor.

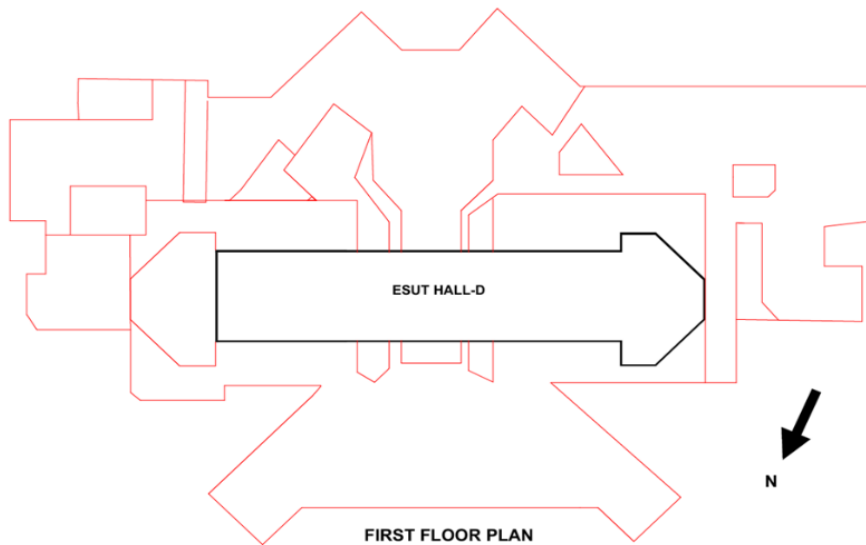


Figure 4. The reading space is located on the first floor plan.
(add source/reference)

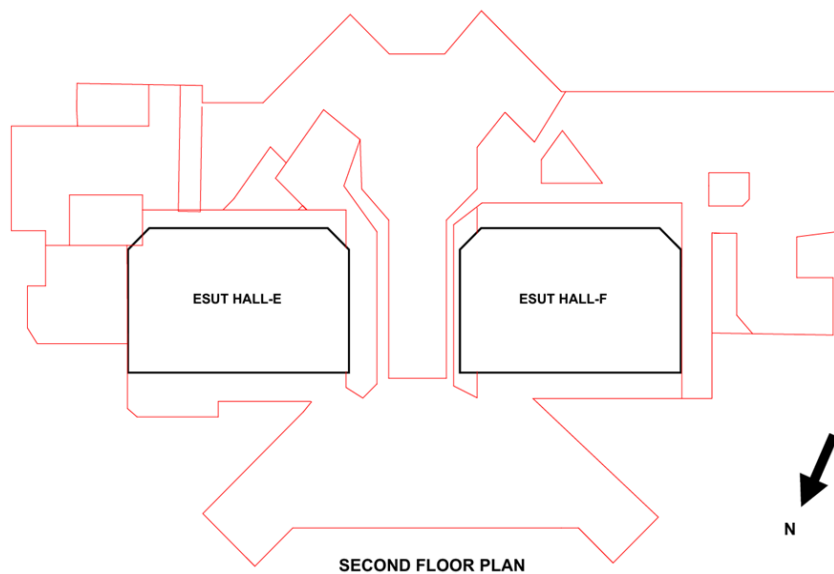


Figure 5. The reading spaces are located on the third floor plan.
(add source/reference)

The building design features for the first and second floors are twenty-five in number and are summarized in Table 4.

Table 4. Reading areas at the first and second floor of ESUT Library complex.*Source: Author's fieldwork*

READING AREAS – FIRST AND SECOND FLOOR			
S/ No	ARCHITECTURAL DESIGN FEATURES	Hall D – First floor (Science and Technology/ Serial section)	Hall E and F – Second floor (Digital section)
1.	Space Geometry	Rectangle	Rectangle
2.	Location	-	-
3.	Space Floor Level	First Floor	Second floor
4.	Fenestration	Side- lighting	Side- lighting
5.	Type of windows used	Projected glazed/ aluminium	Projected glazed/ aluminium
6.	Locaton of windows	Three sides	Three sides
7.	Glazing transmittance	6 mm single clear	6 mm Single clear
8.	Shading devices	None	None
9.	Wall Finishing	Painted	Painted
10.	Wall color	Creame	Creame
11.	Furnitures provided	Tables /chairs / shelves	Reading table/ chairs
12.	Furniture arrangement	Four-seating	One- seating
13.	Height of furniture Shelves - Tables -	2.25 m 0.75 m	0.75 m
14.	Type of door	Opened from stair lobby	Opened from stair lobby
15.	Floor finish	Ceramic tiles	Ceramic tiles
16.	Ceiling material	White painted slab	PVC strips
17.	Source of obstruction	Yes	Yes
18.	Height	3.7 m	3.2 m
19.	Window sill level	0.6 m (21 nos), 0.3m (6 nos)	0.9 m (12 nos), 1.1m (1 no)
20.	Window widths – Window height -	0.82 m – 3.5 m 2.2 m	0.82 m – 1.82 m 1.9 m (12 nos), 0.45 m (1 nos)
19.	Floor area	704 m ²	442 m ²
20.	Wall area (no openings) – Wall area -	549 m ² 391.7 m ²	270.4 m ² 234.6 m ²
21.	Number of windows	27	13
22.	Windows total area	185 m ²	35.8 m ²
23.	Window – Wall –Ratio	34 %	13 %
24.	Window – Floor – Ratio	26 %	8 %
25.	Main source of light	Daylight and electricity	Daylight and electricity

4.2. Description of the Selected Reading Spaces and their Illuminance Readings

4.2.1. Esut-Hall A

ESUT-Hall A is one of the reading spaces that is known as, the social science section. The pictorial views of this reading space are shown in Figure 6.



Figure 6. Pictorial views of ESUT-HALL A (Social science section – ground floor).
Source: Author’s fieldwork

It is a rectangular-shaped reading space located on the left-hand side of the second floor with no source of obstructions on the site. The area has three columns that are located in the middle. The nine sides of the walls made it look like a bullet (see Figure 7), and are painted with cream-colored paint. The wall area is equal to 194.6 m² as shown in Figure 2.

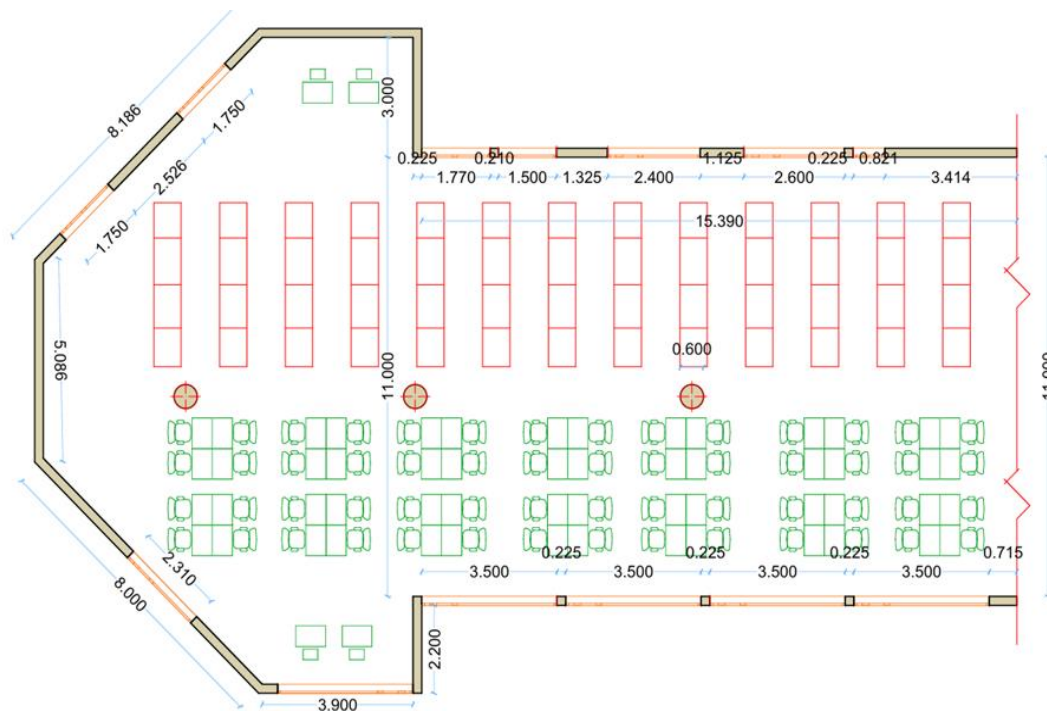


Figure 7. Floor plan of ESUT-HALL A (296 m², WFR = 35%).
(Add source/reference)

The height is about 3.5 m as shown in Figure 1.8. The exterior sides of the walls have no shading device, one side has an obstruction that is still part of the building. The floor is finished with ceramic tiles on a level. The area of the floor is approximately 296.4m². The ceiling is a white-painted slab and is located at a height of 3.5 m above ground level. The windows are located on the five sides of the walls (side lighting). The window is a clear-glazed/aluminum projected type with glazing transmittance equivalent to a glass of 6mm thickness, and they are 13 in number. The wall-window-ratio (WWR) and wall-floor-ratio (WFR) were derived accordingly. The pieces of furniture identified are reading tables, chairs, and bookshelves. The furniture arrangement is on three rows with the bookshelves on one row, and the tables and chairs are in four-seating each on the remaining two rows. The heights of tables and shelves are 0.75 m and 2.25 m respectively. The light source is both daylight and natural light.

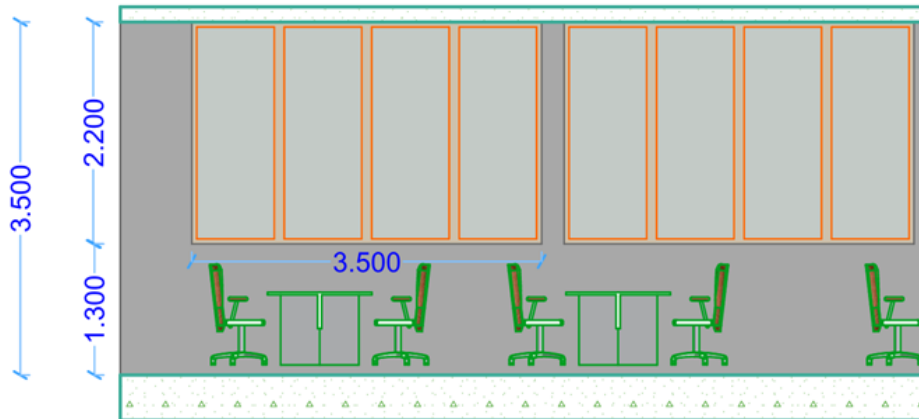


Figure 8. Typical wall elevation of ESUT-HALL A (296 m sq, WFR = 35%).
(add source/reference)

4.2.2. Esut-Hall A Illuminance Readings

The HS1010 light meters were placed at the positions / sensors numbered from 1 – 9 as shown in Figure 1.9, and readings were taken at 15 minutes. The average was accumulated hourly from 8 am to 4pm, and the mean illuminance for the overcast period was determined.

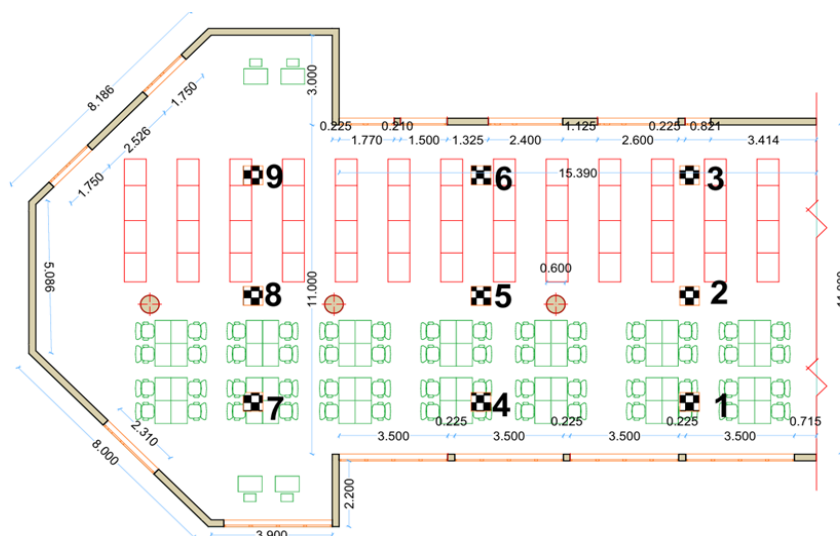


Figure 8. ESUT-HALL A showing the 9 sensors and positions.
(add source/reference)

The illuminance readings from morning (8 am) to evening (4 pm) were summarized in Table 5.

Table 5. Hourly illuminance readings of Esut-Hall A.

Time	8 am (lux)	9 am (lux)	10 am (lux)	11 am (lux)	12pm (lux)	1pm (lux)	2pm (lux)	3pm (lux)	4pm (lux)	Mean /sensor	Total mean
Sensors											
1	250	755	470	1153	555	860	765	797	645	694	369 lux
2	291	537	373	590	395	575	465	552	360	458	
3	150	145	140	103	102	130	120	122	145	129	
4	251	503	660	624	708	610	412	331	245	483	
5	220	346	320	472	440	450	370	285	195	344	
6	202	209	208	206	207	212	210	211	208	208	
7	240	548	644	620	641	552	519	432	338	504	
8	280	304	398	445	432	565	420	343	301	388	
9	105	106	104	112	104	107	108	118	131	111	

The mean illuminance value for the Esut-Hall A under an overcast sky condition was found to be within the range of 300 lux and 500 lux.

4.2.3. Esut-Hall C

ESUT-Hall C is also one of the reading spaces that is known as, the reference section. The pictorial views are displayed in Figure 9.



Figure 9. Pictorial views of ESUT-HALL C (reference section – ground floor).

Source: Author's fieldwork

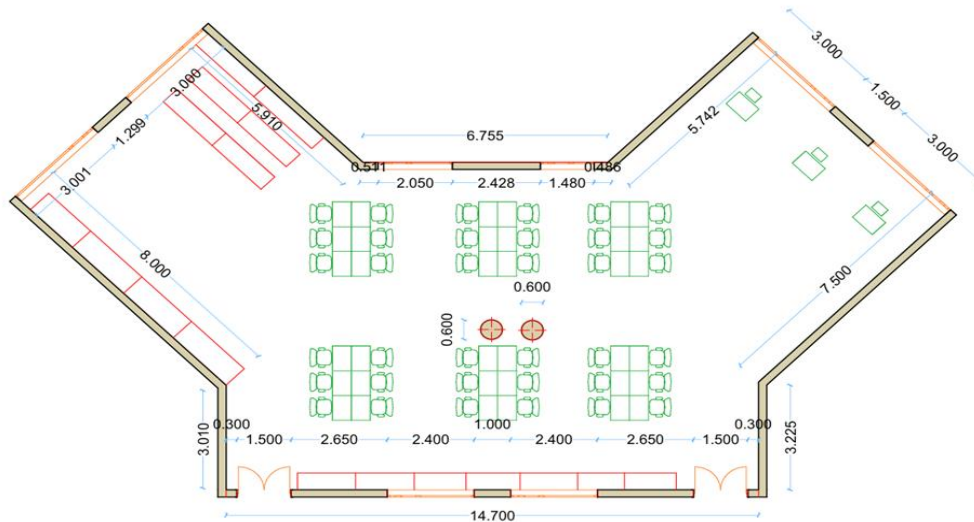


Figure 10. Floor plan of ESUT-HALL C (216.8 m², WFR = 15%).

(add source/reference)

The height is about 3.2m. The exterior sides of the walls have no shading device. The floor is finished with ceramic tiles on a level. The area of the floor is approximately 216.8 m². The ceiling is made of white PVC strips and is located at a height of 3.2m from the ground level. The windows are located on the four sides of the walls (side lighting). The side with two windows and two doors is obstructed by a long corridor, making those windows ineffective. It can be said that there are only six effective windows. The window is a clear-glazed/aluminium projected type with glazing transmittance equivalent to a glass of 6 mm thickness, and they are 8 in number. The wall-window ratio (WWR) and wall-floor ratio (WFR) were derived accordingly. The pieces of furniture identified are reading tables, chairs, and bookshelves. The arrangement is not sequential, and the tables-chairs are six-seaters each. The heights of tables and shelves are 0.75 m and 2.25 m, respectively. Light sources are both daylight and natural light.

4.2.4. Esut-Hall C Illuminance Readings

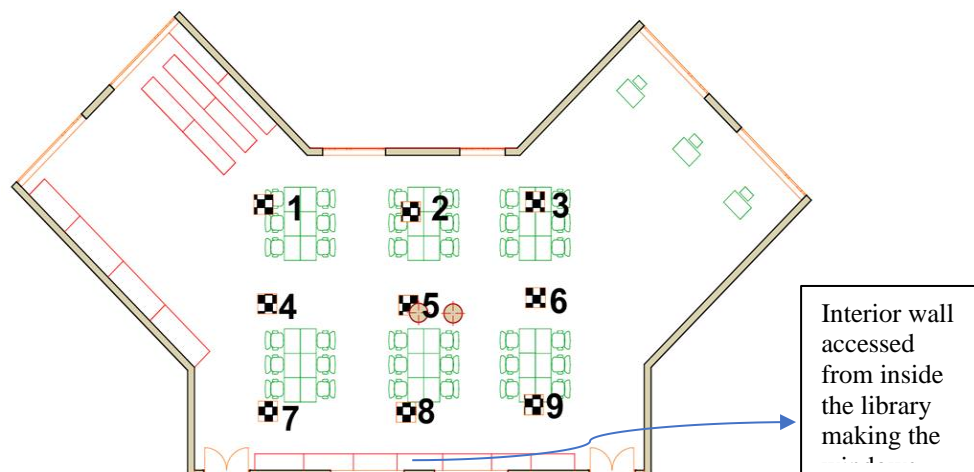


Figure 11. ESUT-HALL C showing the 9 Sensors/positions.

(add source/reference)

The illuminance readings from morning (8 am) to evening (4 pm) were summarised in Table 1.6.

Table 6. Hourly Illuminance readings of Esut-Hall C

Time Sensors	8 am (lux)	9 am (lux)	10 am (lux)	11am (lux)	12pm (lux)	1pm (lux)	2pm (lux)	3pm (lux)	4pm (lux)	Mean /sensor	Total mean
1	480	854	310	400	657	315	345	485	395	471	285 lux
2	580	354	269	475	685	335	320	385	411	424	
3	354	511	568	416	370	520	470	577	546	481	
4	192	279	316	419	370	520	470	577	546	481	
5	585	618	620	647	796	807	331	485	441	592	
6	278	187	214	220	258	234	130	176	139	204	
7	13	15	10	18	15	12	12	13	18	14	
8	08	12	12	17	11	14	14	14	16	13	
9	02	10	03	08	03	04	10	10	14	07	

The mean illuminance value for the Esut-Hall C under an overcast sky condition was found to be below the range of 300 lux and 500 lux. The sensors (1, 2, and 3) seem to give the highest illuminance values since they are near the exterior walls with windows (effective windows), while sensors (7, 8, and 9) give the lowest values because they are near the interior walls with windows (ineffective windows).

4.2.5. Esut-Hall F

ESUT-Hall F is another selected reading space that is known as, the digital library. The pictorial view is shown in Figure 12.



Figure 12. Pictorial views of ESUT-HALL F (Digital library – second floor).

Source: Author's fieldwork

It is a rectangular-shaped reading area located on the left side of the second floor with no obstructions. The area has 16 obstructing columns. The six sides of the walls are painted with cream-coloured paint. The wall area is equal to 270.4 m². This is shown in Figure 13.

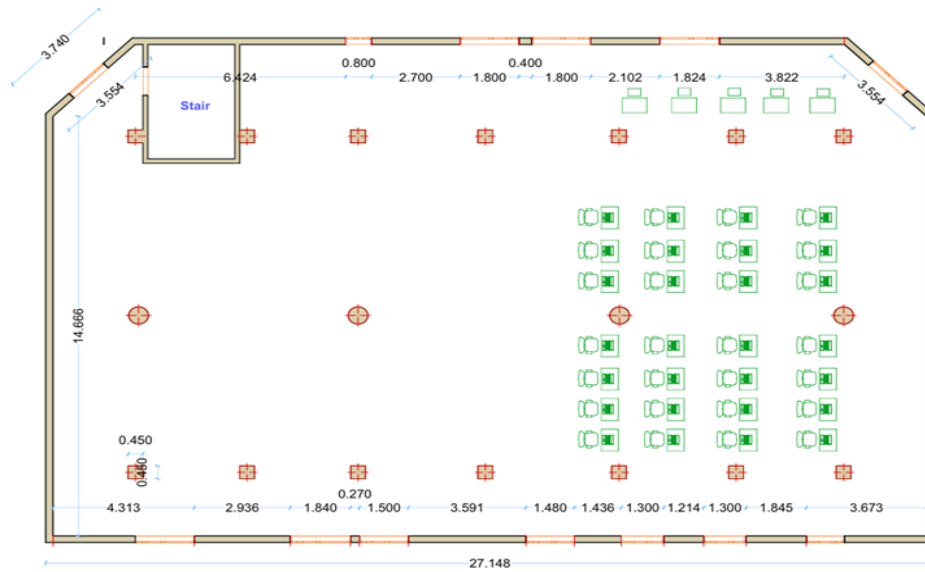


Figure 13. Floor plan of ESUT-HALL F (442 m², WFR = 8%).
(add source/reference)

The height is about 3.2 m. The exterior sides of the walls have no shading devices. The floor is finished with ceramic tiles on a level. The area of the floor is approximately 442 m². The ceiling is made of white PVC strips and is located at a height of 3.2 m above the ground level. The windows are located on the two sides of the walls (side lighting). The window is a clear-glazed/aluminium projected type with glazing transmittance equivalent to a glass of 6mm thickness and is 13 in number. The wall-window ratio (WWR) and wall-floor ratio (WFR) are derived accordingly. The furniture identified are reading tables and chairs. The arrangement for tables and chairs is one-seating each. The height of the tables is 0.75 m. Provisions were made for both daylight and natural light.

4.2.6. Esut-Hall C Illuminance Readings

The HS1010 light metres were placed at the positions or sensors numbered from 1 – 9 as shown in Figure 14, and readings were taken at 15 minutes. The average was accumulated hourly from 8 am to 4pm, and the mean illuminance for the overcast period was determined.

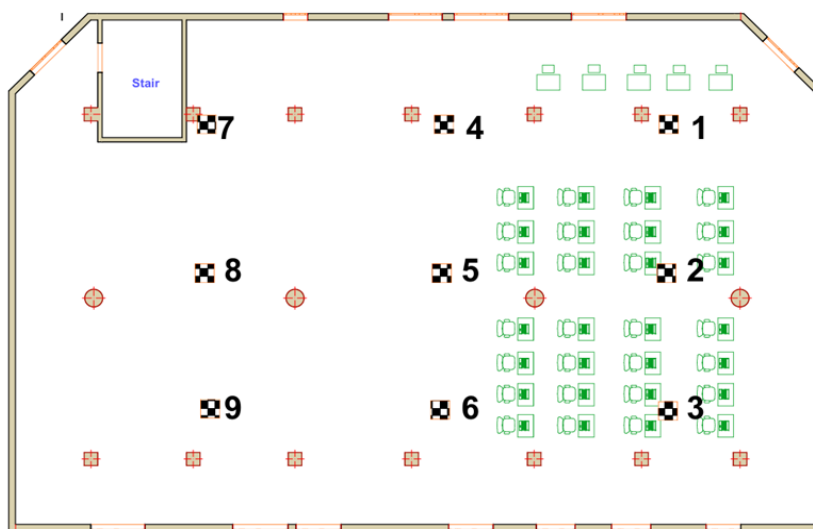


Figure 14. ESUT-HALL C showing the 9 Sensors/positions.
(add source/reference)

The illuminance readings from morning (8 am) to evening (4 pm) were summarised in Table. 7.

Table 7. Hourly Illuminance readings of Esut-Hall C

Time	8 am	9 am	10 am	11 am	12pm	1pm	2pm	3pm	4pm	Mean	Total
Sensors	(lux)	(lux)	(lux)	(lux)	(lux)	(lux)	(lux)	(lux)	(lux)	/sensor	mean
1	210	221	212	438	330	317	225	218	218	243	427 lux
2	320	433	426	560	537	533	460	435	335	449	
3	255	452	542	660	659	515	437	545	339	489	
4	250	276	236	272	381	393	205	218	247	275	
5	325	438	437	576	550	550	457	457	341	459	
6	207	567	685	705	655	592	582	457	485	571	
7	212	217	212	340	335	330	318	217	212	266	
8	320	425	427	570	652	642	534	522	423	502	
9	430	541	632	755	756	673	502	592	444	592	

The mean illuminance value for the Esut-Hall F under an overcast sky condition was found to be within the range of 300 lux and 500 lux.

In this study, the experimental approach was used to determine the daylight condition (illuminance level) that gives rise to daylight quality of those reading spaces under overcast sky conditions. HS1010 light metre was used. The HS1010 light meter's accuracy was tested in a room space to ensure its manufacturers' specifications. Readings were recorded from H1010 light tools placed at nine equal positions with the electrical light turned off from 8 am to 4 pm at 15-minute intervals holding them to obtain daily daylight readings. The readings obtained were 369 lux, 285 lux, and 427 lux for Esut Hall A, Esut-Hall C and Esut -hall F, respectively. Since Esut-Hall A is in the same WFR group with Esut-Hall B and Esut-hall D, they will maintain the same illuminance values. The same thing applies to others. Therefore, the illuminance values for all the reading spaces are summarized in Table 8.

Table 8. Reading spaces with their WFR (%).

S/N	READING AREAS	Illuminance values (Lux)	Remark
1.	ESUT-HALL A	369	Within the recommended range
2.	ESUT-HALL B	369	Within the recommended range
3.	ESUT-HALL C	285	Below
4.	ESUT-HALL D	369	Within the recommended range
5.	ESUT-HALL E	427	Within the recommended range
6.	ESUT-HALL F	427	Within the recommended range

Since the recommended required daylight level for the library reading and studying area is between 300 lux and 500 lux, only five of the reading spaces are within this range. Those five reading spaces are Esut-Hall A, Esut-Hall B, Esut-Hall D, Esut-Hall E and Esut-Hall F.

The architectural design features of those reading spaces that have illuminances within the range of 300 lux – 500 lux were analysed to understand their influences on the illuminance level (daylight quality). The features that have no variance can still be maintained, but the features that vary, the ones meant for these five reading spaces are to be considered. To achieve good daylight quality, the space geometry can either be rectangular or shape. The window can be located on three sides of the walls, the doors should be opened from a lobby, the ceiling materials can either be a white slab or PVC, no serious obstructions, the windows can be as many as possible, window wall ratio should have a minimum of 13% and a maximum of 53%, and the window floor ratio should have a minimum of 8% and a maximum of 35%. For Esut Hall C, the WWR and WFR are within the range, and most of its building design features are similar to the other five, but the two ineffective windows that were obstructed by a long internal corridor seem to be the cause of not meeting the recommended level of 300 lux and 500 lux.

5.0 CONCLUSION

The paper aimed to determine the influence of architectural features on daylight quality. The quality of the daylight was determined by obtaining the values of illuminance in the six reading spaces. The result showed that five out of the six readings had good daylight quality under overcast sky conditions. Most of their daylight design features are similar, therefore, they collectively positively influenced the daylight quality. The only reading space that had bad quality had some windows that were ineffective due to its position within the interior of the building and obstructions from the daylight source. Therefore, the recommendation is that the area of the effective windows should be increased to compensate for the ineffective windows. In addition, since that space has no other floor on its top, top light windows should be introduced.

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