

# Assessment of Lighting Strategies and Their Influence on Users' Experience in Art Galleries

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## ABSTRACT

Adequate daylighting represents both an element of pleasure and at the same time, an element of pain. Often, these two essentials tend to conflict with one another since revealing artwork to a source of concentrated light can sometimes affect its eminence. There is, therefore, a significant need to assess lighting strategies used in art galleries and their influence on users of art galleries. This project aims to assess lighting strategies and their influence on the users of selected art galleries. This research made use of quantitative research approach. The data were collected through a structured questionnaire, and the IBM SPSS (Statistical Package for Social Sciences) was used to analyze the quantitative data. Results show that natural lighting is essential in achieving a positive user experience, and the positioning of openings should be considered when designing an exhibition space to avoid glare. Conclusively natural lighting should be considered in designing exhibition spaces. In other to achieve this natural lighting without hurting the users, positioning of the opening ought to be considered carefully. In conclusion, lighting strategies used in an exhibition space affects the experience of users; thus, designers should put into consideration the user experience when designing an exhibition space.

## Keywords

art galleries, lighting, lighting strategies, user experience

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## Introduction

Light plays a vital role in our daily lives to the point that it influences user experiences of spaces as well as the general well-being of that user over a significant percentage of the day in the built environment. Light (Natural light or Daylighting) is seen as one of the most important attributes that influence both the physical and psychological comfort of users of different structures (Kellert, 2008). Lighting is not frequently considered, but it plays a crucial role in enhancing spaces for functionality, wellness and enhancing the culture of a place. It is a primary system for accomplishing energy efficiency and visual utmost satisfaction.

Exhibition halls are described as places to promote and share common interests of arts and culture. They are typically buildings in which showcases and presentations of various kinds are organized, and they are fast becoming a recognized momentous way of expressing creativity and art. These presentations are usually not just for displaying artworks but also exhibiting the cultural heritage of the people where the building is located. In Nigeria, Exhibition halls are getting to be ruined and underutilized through the descending pattern of support of the museum brought about by the looming loss of human character (Ndandok, 2005). The value of an exhibition hall and amount of fascination in the culture and artefacts being displayed in such places solely rest on the architecture of the exhibition hall (which bears into consideration adequate natural lighting), the style of preservation of the artefacts on display (and in-store), the collections of the exhibition hall, and the experience derived through circulation (Byrne *et al.*, 2006). Adequate daylighting gives a legitimate significant amount of lighting for proper colour interpretation and has excellence which gives suitable human reactions to visual arts in the display.

It likewise brings the understanding of sentiment, happiness and brilliance, which gives a significant effect on audiences (Li & Lam, 2001).

Exhibition halls should be very comfortable in all aspects. Lighting, amongst other elements that constitute the design of spaces, is an essential feature in designing spaces within a building because it plays a principal role in the appreciation of the objects of arts and culture. Natural lighting is significant for achieving a conducive visual environment in an exhibition hall, and its transmission influences the degradation of artworks. The likelihood of conserving delicate objects of art is sternly associated through the likelihood of monitoring thermal and lighting conditions within an exhibition area. However, the healthier application of daylight may diminish the necessity for artificial lighting and thermal heat instigated by solar energy and electric lighting (Carla & Elena, 2010). Usage of lighting in exhibition halls varies based on the building size, the nature of the exhibition area and the works of art to be exhibited.

Similarly, the lighting approach to be used for two-dimensional objects will vary from three-dimensional objects (Kim & Chung, 2011). Conferring to Arthur van der Zaag (2017), appropriate lighting techniques will give the watcher an encounter of both the physiological, sociological and mental impact apparent from the works of art. "The basic point of lighting design and the set is to make the best condition for viewing objects" (Lords & Piacente, 2014). Creative daylighting approaches can be engaged to tackle the necessity for low lighting levels. Key factors to be considered include; adoption of natural (daylight) against artificial light and the impact of such light on both the artwork and artefacts and how it promotes the observer's experience. This research work recognizes the importance of lighting in the exhibition area, and it intends to examine the impact of this lighting in art galleries.

In understanding, how natural light impacts a space, careful consideration has to be given to the amount of daylight penetrating an exhibition hall (Hunt, 2009). Hunt (2009) also states that while daylight enhances the overall atmosphere of the space, this light has an undesirable impact on artefacts. Thus, daylight and conservation of artefacts generally conflict. Hence, compromises have to be made in designing an exhibition hall. Adequate daylighting signifies both a component of pleasure (through the enhanced perception of little specifics and colours on works of art) and at the matching time an element of pain (due to deterioration). Often, these two essentials tend to conflict with one another since revealing artwork to a source of concentrated light can sometimes affect its eminence. A happy medium is essential to allow optimum visual gratitude of the art and to ensure that its physical appearance is not polluted. (Led Standard, 2019). There is, therefore, a significant need to assess lighting strategies used in art galleries and their influence on users of art galleries. This project was aimed at assessing lighting strategies and their influence on the users of selected art galleries. The study seeks to achieve the following objectives:

1. To evaluate the existing lighting strategies in art galleries
2. To evaluate the perception of users on the related problems on the lighting experience in art galleries
3. To evaluate the experience of users of the art galleries.

## Literature review

### Context of the study

Exhibition halls were created from a longing of man to keep and gather anything unmistakable, pleasant, inquisitive, and helpful, which means the historical backdrop of exhibition hall can be said to be gone back to the Stone Age. Exhibition halls have had its starting point implanted in the cultural acts of various regions of the world. Exhibition halls have many functions such as cultural centre, historical record centres, and a forum for learning. These halls serve several purposes such as educational purposes, entertainment purposes, and social purposes. An art gallery is a type of exhibition hall. Art galleries are exhibition halls where the "spaces are committed to the demonstration of craftsmanship perfect works of art" (Bell, 2002). Art galleries could be focused on the demonstration of expressive arts of a particular kind, class, or period or gems by an explicit craftsman or social occasion of experts. Some artistry exhibition halls even focus on the demonstration of fine arts picked up by a single power; a representation is the Nike art gallery in Lagos. Craftsmanship historical centre grandstands creative accomplishments, and through presentations, they upgrade watchers getting gratefulness and affirmation of artistry. They contain various sorts of expressive arts, including aesthetic manifestations, shape, prints, outlines, photographs, stoneware generation and glass, metalwork, and furniture. An artistry exhibition hall speaks to different cultural legacies from all bits of the world. One collection may contain Egyptian sculpture, funerary things, and precious stones; another might contain a figure, spread, and utilitarian articles from Africa; and

another might contain earthenware, materials, beadwork, and basketry from nearby social events of the Western half of the globe (Ndandok, 2005).

### Conceptual framework: Lighting

Natural light helps stimulate sight and makes things visible. The ruling factor in the lighting plans of exhibition halls is the nature of light. Although, all objects of art and artefacts need adequate light to show their colour and appearance, the overall splendour of works of art and contrast, and glare coming about because of direct daylight are the most significant issues (Arthur van der Zaag, 2017). As ultraviolet light will, in general, deteriorate most works of art in plain view in exhibition halls, it would appear to be imperative to work with low brightening levels and to verify that these are kept up for the brief span intervals. It likewise recommends that all-natural light sources ought to be fit for being darkened so that daylighting can be directed when it gets extreme and if fundamental wholly rejected. It is hard to give a "safe" level of brightening for delicate materials because any light may cause some weakening. Somewhat the point of confinement forced on the light level must be self-assertive and reliant on the object being illuminated (Simon, 2015). The nature of light acquired from north-bound openings has for quite some time been considered as the best; nonetheless, different components may make it difficult to get light with "north" light characteristics (Williams, 2008). At whatever point directional sunlight is utilized in the exhibition hall, the opening letting it be known ought to be planned so the light is reviewed and glare avoided. Openings ought to likewise be set in such a position or screened in such a way, that the eye will not see the Sky or other brilliant territories. Commonly, daylighting in the exhibition hall is always provided by using elevated opening and clerestories (Hunt, 2009).

### Lighting strategies in art galleries: A review of studies

Light is crucial to the general well-being of persons that regularly make use of a physical facility over a significant percentage of the day. Light is the brilliance that quickly falls into place from the sun or misleadingly from electrical gadgets, and that permits things to be seen (Usikal, Shittu, & Obafemi, 2018). Light is the average that discloses colour, texture, shape and space to our eyes and hence the giver of charisma (Simon, 2015). Lighting according to the dictionary of architecture and building constructions is the provision of light for spaces in a building by the controlled placing of lights, and fenestrations (Nikolas & Erkki, 2008). Lighting, amongst other elements that constitute the design of spaces, is a vital and essential factor in designing spaces within a building. Lighting is not considered, but it plays a crucial role in enhancing spaces for functionality and wellness. The lighting within a space has influences on the brain research of the crowd and compliments the elegance of the space (Aderonmu, Adesipo, Erebor, Ediae, & Adeniji, 2019). However, there are different kinds of lighting, from natural daylighting to artificial lighting. Natural lighting is gotten from nature and can be found anywhere. Architectural daylighting deals with natural lighting in a building. Its drive is to meet every obligation for decent

optical work and favourable environments by making provisions for optimum illumination in a room (Singh, 2018). Daylight continually fluctuates and regularly is merged into the collaborative spaces. Insightful thought must be indicated to the effect of light to have an element of the daylight that would be adequate to infiltrate the exhibition is inside. Investigating elements, for example, solar ray, glare, reflection and space acclimation, must be done successfully (Alshaibani, 2015).

Lighting design is a vital issue for sustainable buildings (Ferna, 2012). Daylighting is a standard, freely disseminated essentials which are a component of most buildings (Singh, 2018). Daylighting is the use of sunlight to diminish artificial lighting (Mohapatra, Kumar, & Mandal, 2018). They also stated that daylighting is most operative when sunlight falls on fenestration throughout the day. Light is brought into space through fenestrations. Fenestrations are effortlessly understood to be equally a lighting device and an architectural motive (Oksanen & Norvasuo n.d.). Every building has its peculiar daylighting problems and the concentration of daylighting that should be used for such buildings. The amount of daylighting going into an interior is depended on the fenestration area (Li, Cheung, Cheung, & Lam, 2010). This also depends on the amount of daylighting available on-site and materials used for filling the openings.

### Lighting in art galleries

Lighting is vital for human interaction within a space. It nonetheless plays a significant role in developing interaction between audience and works of art in a defined space. Lighting plays a significant role in our day-to-day lives. However, exhibition halls are a place where lighting design is crucial to the overall understanding (Lowe, 43, 2009). Lighting is a principle design part of the exhibit spaces that empowers the watchers to acknowledge shape, concealing, edge, space and surfaces inside the exhibition halls. It can impel perspectives and sentiments in the exhibition hall crowd this way, giving the watcher's critical encounters.

The lighting used in an exhibition hall is a crucial segment in the demonstration of compelling artwork. The lighting in an exhibition hall adds to the shielding of artefacts and urges the watcher to see the work. Mayowa (2015) states that Light wavelength and its force can hurt a masterpiece, especially a delicate work of art, for instance, a print, drawing, photograph or water concealing. An artistic work's degree of flexibility of light will depend upon the materials used to do the work and the level and length of introduction to light during the display. A couple of inks, hues and surfaces are helpless to the extended prologue to light. The degree of bright light used in a show space needs to think about both the insurance needs of the artistic work and the necessities of the watcher's involvement.

Inventive lighting techniques can be used to discourse the prerequisite for low lighting levels; for example, by diminishing the degrees of including light underneath the level falling on the display, or by the usage of spotlights. Various issues which ought to be considered over are the use of daylight against artificial light and the impact of such lights on both works of art by artists and how it empowers the watcher's understanding (Mayowa, 2015). The utilization of daylight in the exhibition space should think

about the possibility of the article on display, the enlistment of warmth close by over the top direct beam shafts, the privilege arranging of wall fenestrations or lookout window, the usage of channels to avoid outlandish consent of daylight, and the presentation of another lighting for late evening survey and dark or overcast days. At the point when daylight and artificial light are mixed, their pillars should be blended before they fall on a work of art. Armas (2011) states that this similarly infers the spatial scattering of the two sorts of light ought to be well-thought-out. Conferring to Oksanen and Norvasu, (2005) there are various categories of radiation that are possibly destructive to materials used in works of art. Thus, the light presentation cutoff points of these assets must be very much idea out in lighting philosophies. As expressed by Alago (2010) that the quality and lighting up the level of lighting for the jam-packed solace in the display corridor will choose the accomplishment or dissatisfaction of the galleries plan. Having a fixed and suitable control of the utilization of a various assortment of lighting in the display will empower to pull in the gathering of observer's enthusiasms to the feature object of articulations.

Natural lighting is the controlled consent of direct daylight into the structure and through the satisfactory arrangement of sufficient direct association to the dynamic and relentlessly creating instances of outside illumination. Natural lighting can help in making an outwardly animating and beneficial condition for client's while boosting visual solace and lessening vitality use. Natural lighting delivers high illuminance and allows exceptional colour discernment and colour interpretation. The proportion of daylight arriving at the ground varies with the zone, area, scope, environment, condition, air quality and power of the daylight. The sun discharges a force development up to 63MW with close to 134Kilolux achieves the world's outside air customarily called light. The International Commission on Illumination orchestrated the sky atmosphere into a sensible sky and overcast sky. Li, Cheung, Cheung, and Lam (2010) additionally distinguished regular lighting reflected from its close by and ground buildings assume specific roles in the original lighting plan. The natural lighting that is accessible in the interior building relies upon the measure of natural light that enters the window region.

Lighting fills in as a significant job in making an association among individuals and exhibition hall ancient works of art to give an intuitive encounter for the guests, and secure the condition of the curios. Daylighting can be used to a mind-boggling impact to make any structure configuration animate (De Chiara & Corbie, 2007). Light consistently changes, and much of the time is melded into the intuitive spaces. A genuine thought must be given to the light effect to have an estimation of the daylight that would be permitted to invade the gallery inside. Breaking down components, for example, glare, space acclimation, reflection, sunlight-based beams must be done viably (Alshaibani, 2015). An extreme measure of brilliant light or glare would make uneasiness the guests which will fundamentally influence their encounters in the exhibition halls. In this way, the suitable fuse of daylight components in lighting structure should be practised to make the exhibition halls experience natural and pleasant. Daylight

has a massive impact of adding climate to spaces. Nevertheless, it in like manner adversely influences the artefacts because of the high light yield and high centralization of beautiful beams. These beams are dangerous to the antiquated works of art and materials when introducing to light. Subsequently, sway how daylight can be utilized in exhibition hall space (Elizabeth, 2009). Ambient lighting is essential when it comes to achieving high-quality lighting for artwork (Varzgani, 2015). He also states that light on the artwork should be about multiple times as brilliant or exceptional as the encompassing light as it permits the work of art to show up in the closer view and centred.

### Daylighting systems and design strategies

There are two types of daylight strategies which are lighting from side and lighting from the top. Lighting from the side and the top are the first types of strategies. The system of daylighting will be subject to the orientation and the layout and the building surroundings. (Aminudin, 2015).

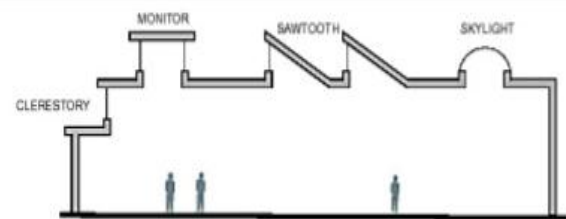
#### Side lighting

Side-lighting is the method of bringing in daylight through the apertures created on the walls. This method admits a robust directional light, which diminishes as the distance increases. Vertical windows are the conventional and typical method of natural lighting (Obioha & Ayodele, 2014). In a gallery space, side-lightings are often discouraged, as they occupy the space on walls and are likely to produce glare. Clerestories are another type of vertical windows. For a gallery space, this method of introducing light is the most effective (Baker & Steemers, 2014). The daylight is admitted from a height into space without creating any discomfort glare. This method also allows brighter and deeper daylight penetration into space with less variation in the illuminance as compared to other systems. Light entering from higher point arrives at the vertical surface with no obstacle, consequently maintaining a strategic distance from undesirable shadows (Fontoynont, 2013). Clerestories are commonly used for daylighting art galleries.

#### Top lighting

In this concept, the light is allowed from the top of the room into space. Pattern from top lighting is different from the side-lighting systems. Top lights are usually much brighter than sidelights per unit area, for the same glazing properties. Top lighting restricts natural light to the upper level of the building. If the roof light is not placed strategically, it may allow direct sunlight which can cause a discomfort glare inside the space. Roofs are planes on which these apertures are located and will allow a large quantity of light inside which can be distributed throughout the room. Top lighting exhibits the same behaviour as unswerving electric lighting does by blistering light downwards into space which follows a principle frequently used for designing lighting systems. Top lighting is not necessarily affected by the orientation of the building, site or adjoining buildings. There are numerous standard models for top lighting:

- a) The skylight: it is known as the horizontal glazing which permits the entrance of direct Sky and solar radioactivity through a fenestrated opening or aperture.
  - b) The Single Clerestory: This prototype produces direct and indirect lighting by the introduction of light through a perpendicular clerestory window. Some of the lighting coming through the vertical clerestory window may be reflected downwards from the ceiling into the space dependent on the adjacent roof. Also, the site orientation or the orientation of the building of the site should be very well considered as a relatively high percentage of direct light can cause glare and discomfort to the occupants of a space.
  - c) The saw single tooth clerestory: This prototype produces direct and indirect light with a high percentage of the light bouncing off an adjacent slanted window in the space thereby increasing the amount of light coming downwards and minimize the amount of direct light entering the space.
  - d) The Double Clerestory: This prototype is also known as the monitor. It permits the entrance of daylight in abundance into space or building with the proper choice of glazing especially in buildings where orientation or weather does not permit the saw tooth clerestory window or other unusual designs of apertures.
- In galleries, this concept is mostly used as it does not obstruct the exhibition space. This system is often combined with louvres and translucent textures to avoid the direct sun entering the room.



Example of Toplighting Strategies

Plate 2.2 Top lighting strategies

Source: (Qahtan, 2017)

#### Reflectance

Interior surfaces have a significant impact on the performance of daylight in a space. Ceilings are considered an essential surface to reflect and distribute the incoming daylight. After the daylight is entered in the room, walls are the second most crucial surface. Simultaneously, walls have a significant role in art galleries as one of the mediums on which artworks are displayed. The third impact is on the floors.

#### Importance of daylight in art galleries

The chance of safeguarding delicate works of art is carefully associated with the chance of controlling warm and lighting conditions inside the exhibition halls. Better usage of sunlight may decrease the requirement for artificial lighting and inner additions brought about by sun-based vitality and electric lighting (Nduka, Amusan, Akinbile, & Owolabi, 2018). Some of the time, a few intercessions can be important to reduce natural solar radiation all through the windows, for example, changing the sort of glass, embracing



sun-oriented shadings, screening frameworks and sunlight-based gadgets with light diverting properties

### Gaps in literature

Many exhibition halls were initially not designed and built to be an exhibition hall. Since these buildings were not intended to show light on delicate works, the arrangement is to block sunlight and use suitable artificial lighting (Auther Van Der Zaag 2017). However, humans tend to move and appreciate places that are naturally lit. Therefore, the users and visitors do not enjoy their visit to exhibition halls. Hence, there is, therefore, a significant need to assess lighting strategies used in art galleries and their influence on users of art galleries.

## Research methods

### Study population

The study population of this research is the art galleries within Lagos Island in the southwest, Nigeria. The study population is made up of 21 art galleries (Castellote, 2012). The units of analysis are the variables used to measure significant research issues, as highlighted in the objectives. In this study, the unit of analysis is users of the selected art galleries.

### Sampling technique

The sampling technique deployed in the research would be multistage sampling. Purposive sampling was used in selecting the city for a survey, which is Lagos state. Stratified sampling was used in selecting strata between Lagos Island and Lagos Mainland. The selected stratum was Lagos Island. Then random sampling was used in selecting the art galleries to survey in the research. Questionnaires will be distributed using a sensor sampling method through distribution to the art gallery visitors and staff met at the visited art galleries.

### Sample size

Sampling is the process researcher uses to gather people, places, or things to study. Purposive sampling method was used in selecting Lagos Island, while random sampling was used to select art galleries within Lagos Island. Also, a censor sample method was used to select the users.

$$n = \frac{N}{1 + N(e)^2}$$

With  $n$  = sample size,  $N$  = population size,  $e$  = level of precision (5%), and confidence level of 95%; the result produced 20 art galleries as sample size. However, not all art galleries were available during the research period, as a result of this leaving the available art galleries to be five art galleries.

### Data collection instrument

The data-gathering instruments used in this study were the open-ended questionnaire. The questionnaires were prepared for the respondents, which included a list of statements

covering various degrees of positive and negative feelings. The structured questions consisted of specific questions and a choice of possible answers to keep the respondent's mind fixed to the subject matter revealing the depth of respondents' motives, feelings or opinions on specific issues were administered. However, the questionnaires were used on users of the art galleries. Questions like the perception of the respondent on lighting strategies employed, related problems in exhibition halls, and even relevant strategies that can enhance their experiences.

### Data collection units

Due to the nature of the research work, which is Assessment of lighting strategies and their influence on user experience in art galleries, the units of data collection are the users of the selected art galleries. It helped to provide answers to the research questions.

### Data analysis

The descriptive and historical techniques were utilized as primary methods of analysis in this research. According to Boyi (2015), historical analysis can be used to provide information for a current problem being studied and also enables a greater appreciation of culture and society through the logical Assessment of the past and present events and also predict the future direction of museum approach. While the descriptive analysis was utilized to analyze the materials, design layout systematically, and treatment of artefacts in the art galleries studied. Data acquired from questionnaires were used as the basis for data handling and while analyzed using the Statistical Package for Social Science (SPSS).

### Methodology By Objectives

This is the method of retrieving and analyzing all the data in conjunction with the three objectives of this research.

#### Objective 1: To evaluate the existing lighting strategies in art galleries

**a) Data characteristics:** this data made use of both qualitative and quantitative approaches. The existing daylighting strategies were gotten from existing literature, and respondents were asked to rate their perception of the existing daylighting strategies on the Likert scale the extent of agreement with the outlined daylighting strategies used in the art galleries.

**b) Data Source and Instrument:** The data was collected from both the literature review and questionnaires. The literature reviews give the bases for the questions to drawn out while the questionnaires were shared with the users of the art galleries.

**c) Data Analysis and presentation:** The data salvaged on this objective from the literature reviews were analyzed through content analysis and descriptive statistics, while the data gotten through questionnaires are analyzed using SPSS, through descriptive statistics. The results were presented in narrative and descriptive forms and also through tables.

**Objective 2: To evaluate the perception of users on the related problems on the lighting experience in art galleries**

a) **Data characteristics:** This data made use of both qualitative and quantitative approaches in nature. The respondents were asked to rate their satisfaction level of the problems related to daylighting gotten from the literature experienced in the art galleries.

b) **Data Source and Instrument:** The data is collected from questionnaires. The questionnaires were shared with the users of the art galleries.

c) **Data Analysis and presentation:** The data gotten through questionnaires are analyzed using SPSS through descriptive statistics. The results would be presented in narrative and descriptive forms and also through tables

**Objective 3: To evaluate the experience of users of the art galleries**

a) **Data characteristics:** This data made use of a quantitative approach. The respondents were asked to specify their level of agreement under a Likert scale with the identified design strategies that influence their experience in art galleries.

b) **Data Source and Instrument:** The data is collected from questionnaires. The questionnaires were shared with the users of the art galleries.

c) **Data Analysis and presentation:** The data gotten through questionnaires are analyzed using SPSS through descriptive statistics. The results would be presented in narrative and descriptive forms and also through tables.

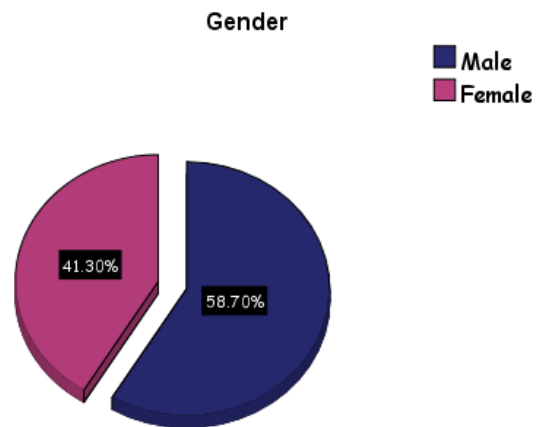
**Results**

The study was carried out to examine the impact of daylighting in exhibition halls from 100 random individuals selected from 5 art galleries that were examined in Lagos state, southwest, Nigeria. Result gotten from the structured questionnaire administered is discussed below. From the administered questionnaires across selected locations, 92 questionnaires were recovered with eight unrecovered. The recovered questionnaires were analyzed using IBM SPSS statistic software.

**Characteristics Of The Respondents**

**Gender**

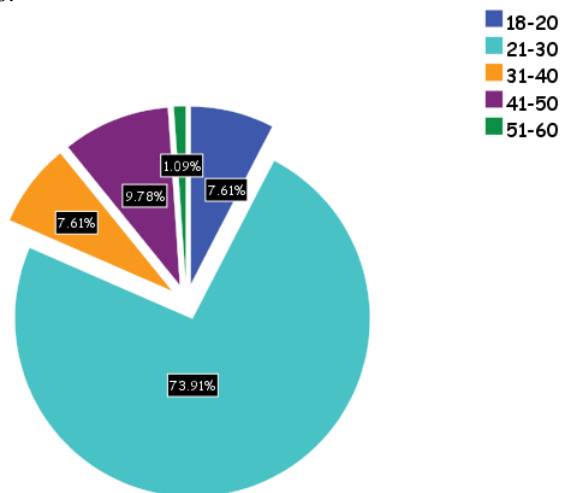
The pie chart in figure 4.1 indicates the percentages of the gender of the respondents that 58.7% (54 numbers) are male and 41.3% (38 numbers) are female. This result shows that male than female visits art galleries more.



**Figure 4.1:** Gender of respondents  
Source: Authors' report (2020)

**Age Range**

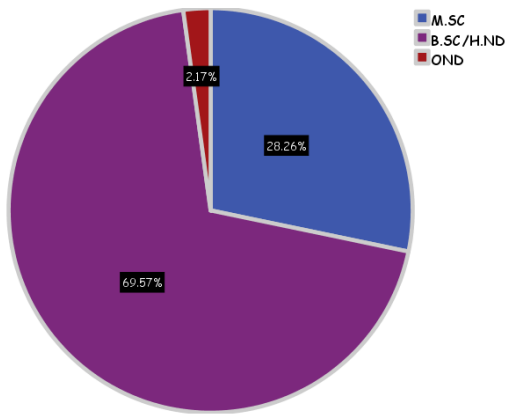
From the figure 4.2, 73.9% of the respondents were between the age range of 21-30 years, 9.8% were between 41-50 years, 7.6% were between 18-20 years, 7.6% were between 31-40 years while the 1.1% of the respondents were between 51-60.



**Figure 4.2** Age range of respondents  
Source: Authors' report (2020)

**Educational qualification**

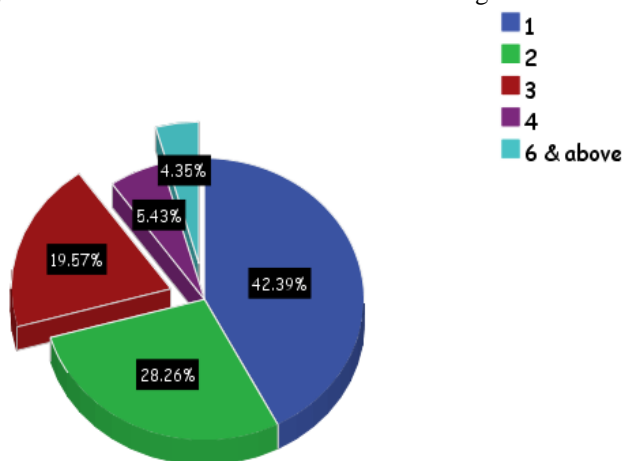
The educational qualification analysis is based on the level of formal education attained by the respondents. Figure 4.3 shows that 28.3% of the respondents have M.SC degree, 69.6% have a B.SC/H. N.D. degree, while 2.2% of the respondents have an O.N.D. degree



**Figure 4.3:** Education qualification of respondents  
Source: Authors' report (2020)

**Frequency of art galleries visited**

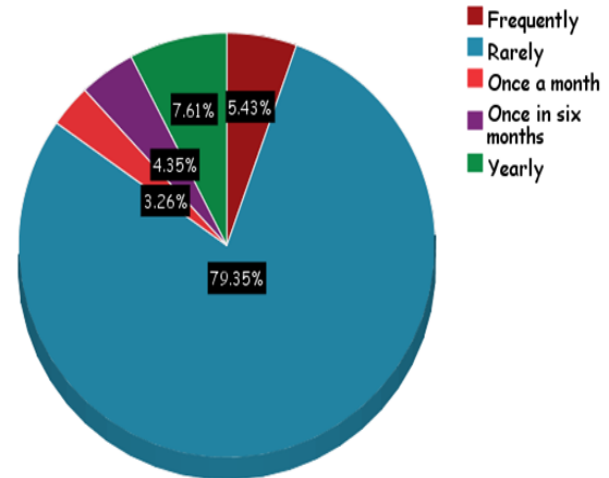
Figure 4.3 shows that the number of times respondent have visited art galleries. 42.4% of the respondents have visited only one art gallery, 28.3% have visited two galleries, 19.6% have visited three galleries, 5.4% have visited four galleries while 4.3% have visited six or more galleries



**Figure 4.4:** Frequency of art galleries visited  
Source: Authors' report (2020)

**Frequency of visits**

The numbers of respondents who frequently visit the art galleries are 5%, 79.3% rarely visit the art galleries, 3% indicates they visit once a month, 4.3% visit once every six months and 7% of the respondents visits the galleries yearly.



**Figure 4.5:** frequency of gallery visitation  
Source: Authors' report (2020)

**Analysis By Objectives**

**Objective 1: Evaluating the existing lighting strategies in art galleries**

Table 4.1 shows the response of the respondent, who were asked about their perception of the lighting strategies existing in the art galleries. Questions were asked on their level of agreement using the linker scale of 1 to 5. Four questions were presented to them about the quality of lighting strategies currently been used in the art galleries and exhibition halls. The set of questions is to help inform about the satisfaction of the respondent on the various lighting strategies utilized.

**Table 4.1:** lighting strategies in art galleries

S/N	Variables	No of respondent	Strongly Disagree (%)	Disagree (%)	Undecided (%)	Agree (%)	Strongly Agree (%)
1	The amount of natural light was adequate	92	16 (17.4%)	20 (21.7%)	21 (22.8%)	31 (33.7%)	4 (4.3%)
2	The room height in the exhibition spaces was adequate	92	8 (8.7%)	18 (19.6%)	19 (20.7%)	39 (42.4%)	8 (8.7%)
3	Displayed artefacts were lighted adequately	92	11 (12%)	15 (16.3%)	20 (21.7%)	35 (38%)	11 (12%)
4	The artefacts depended on only artificial lighting to be displayed	92	12 (13%)	25 (27.2%)	23 (25%)	26 (28.3%)	6 (6.5%)

Source: Authors' report (2020)

17.4% of the respondents strongly disagreed with the adequacy of the amount of natural lighting used in the exhibition halls, 21.7% shows they disagreed, 21% of the respondent were undecided about the adequacy of the amount of natural lighting, 33.7% of the respondent agrees that the amount of natural lighting is adequate while 4.3%

strongly agreed. This shows that majority of the respondents agree with the adequacy of the natural lighting in the exhibition halls.

The respondents were further asked about their agreement level on the room height used if it was adequate in their perceptive. 8.7% of the respondents strongly disagree, 19.6% show that they disagree with the adequacy of the room height, 20.7% are undecided, 42.4% agree with the

adequacy of room height used. In comparison, 8.7% strongly agree with the adequacy of room height used in the exhibition spaces. This result, as shown in Table 4.1, shows that adequate consideration has been put into the exhibition halls to have enough room height for proper illumination, thermal comfort and ventilation.

The respondents' perception of the adequacy of the lighting of the artefacts displayed in the exhibition halls was asked to determine the visibility contemplation of the shown artefacts in the art galleries. 12.0% of the respondent strongly disagree, 16.3% disagree, 21.7% are undecided, 38.0% agree while 12.0% strongly agree with the adequacy of lighting on the artefacts. This result, as seen in table 4.1 shows that the level of lighting on the artefacts was adequate, as a result of this making the artefacts visibility good in the exhibition halls.

The respondents were additionally asked about their perception of the artefacts being depended on only the artificial lights to be displayed. This will determine the comfort of the visitors with the art galleries depending solely on the artificial lighting on the displayed artefacts. 13.0% of the respondent shows that they agree, 27.2% disagree, 25.0% are undecided about the artificial lighting, 28.3% agree while 6.5% strongly agree with the adequacy of artificial lighting used on the artefacts displayed. This result, as seen in table 4.1, shows that the majority of respondents are comfortable with the use of artificial lighting exhibited artefacts.

**Table 4.2:** Descriptive statistics of lighting strategies

Variables	N	Mean	Std. Deviation
The room height in the exhibition spaces was adequate	92	3.23	1.130
Displayed artefacts were lit adequately	92	3.22	1.212
The artefacts depended on only artificial lighting to be displayed	92	2.88	1.156
The amount of natural light was adequate	92	2.86	1.191
Valid N (listwise)	92		

Source: Authors' report (2020)

As seen in Table 4.2, the highest mean value shows 3.23, which shows the respondents' agreement level to the adequacy of room height in exhibition spaces. The second highest been their agreement with the adequacy of lighting on the displayed artefacts been 3.22 shows that high-level consideration was placed on the lighting strategies in the exhibition spaces. However, the lowest mean value, which is 2.86, which shows the adequacy in the amount of natural light used. These results signify that more natural lighting should be considered in the designing of exhibition halls.

**Objective 2: Evaluating the perception of users on the related problems on the lighting experience in art galleries**

This objective is designed to investigate the specific problems related to daylighting strategies in the art galleries design. Questions were asked to determine the perception of respondents using the Linkert scale of 1 to 5, ranging from highly unsatisfactory to highly satisfactory, respectively. Table 4.3 shows the frequency and percentage of the respondent responses to the questions presented to them on the significant problems faced with daylighting in the art galleries.

**Table 4.3:** related daylighting problems

S/N	Variables	No of respondent	Strongly Disagree (%)	Disagree (%)	Undecided (%)	Agree (%)	Strongly Agree (%)
1	The illumination of the exhibition spaces	92	10 (10.9%)	6 (6.5%)	27 (29.3%)	40 (43.5%)	9 (9.8%)
2	The positioning of windows in the building	92	5 (5.4%)	27 (29.3%)	27 (29.3%)	26 (28.3%)	7 (7.6%)
3	Visibility of the objects displayed	92	5 (5.4%)	9 (9.8%)	22 (23.9%)	41 (44.6%)	15 (16.3%)
4	The glare in the exhibition space is desirable	92	3 (3.3%)	21 (22.8%)	27 (29.3%)	33 (35.9%)	8 (8.7%)
5	The lighting of the circulation and exhibition space	92	5 (5.4%)	11 (12%)	27 (29.3%)	35 (38%)	14 (15.2%)
6	Ventilation in the exhibition spaces	90	7 (7.6%)	11 (12%)	23 (25%)	37 (40.2%)	12 (13%)
7	Sufficient circulation in the exhibition spaces	92	4 (4.3%)	16 (17.4%)	29 (31.5%)	34 (37%)	9 (9.8%)
8	Visual comfort in exhibition spaces	92	4 (4.3%)	5 (5.4%)	24 (26.1%)	50 (54.3%)	9 (9.8%)



9	The heating, cooling and ventilation control in the building	92	3 (3.3%)	11 (12%)	34 (37%)	30 (32.6%)	14 (15.2%)
10	The temperature inside the building	92	3 (3.3%)	17 (18.5%)	32 (34.8%)	33 (35.9%)	7 (7.6%)
11	The air quality inside the building	92	5 (5.4%)	11 (12%)	29 (31.5%)	35 (38%)	12 (13%)

Source: Authors' report (2020)

The respondents were asked about their perception of the illumination of the exhibition spaces in the art gallery. The results as seen in table 4.3 show that 10.9% are highly unsatisfied with the illumination of the exhibition spaces, 6.5% are unsatisfied, 29.3% are uncertain about their perception of the space, 43.5% of the respondent are satisfied while, 9.8% are highly satisfied with the illumination of the spaces in the exhibition halls. This indicates that the illumination of the exhibition spaces was considered when designing the space.

The respondents were also asked about their perception of the positioning of windows. 5.4% of the respondent are highly unsatisfied with the positioning, 28.3% are satisfied, 7.6% are highly satisfied. A significant percentage of 58.6% are either unsatisfied or undecided; thus, the position of windows and opening should be critically considered when designing art galleries.

The visibility of the displayed objects enquiry gave a result 5.4% of the respondent are highly unsatisfied, 9.8% are unsatisfied, 23.9% are undecided about their perception, 44.6% are satisfied. In comparison, 16.3% are highly satisfied with their perception of the visibility level of the displayed objects. The result, as seen in table 4.3, indicates the proper level of object visibility has been considered mostly in the art galleries.

The desirable level of glare in the exhibition spaces shows results of 3.3% being highly unsatisfied with the glare in the exhibition spaces, 22.8% of the respondent indicates dissatisfaction with glare, 29.3% are undecided about their perception, and 35.9% of the respondent shows they are satisfied with a glare. In comparison, 8.7% are highly satisfied with the glare level. A significant percentage of the respondents weighing towards being satisfied with glare indicates that adequate consideration were put into the reduction or avoidance of glare into the exhibition space.

The respondents were also asked about their perception of the lighting of the circulation in exhibition halls. A significant percentage of 53.2% weigh towards being satisfied with the lighting while a total percentage of 17.4% are unsatisfied with the lighting and 29.3% are undecided about their perception. From the result shown in table 4.3, 5.4% of the respondent are highly unsatisfied, 12% are unsatisfied, 29.3% are undecided, 38% are satisfied, and 15.2% are highly satisfied. Hence, the lighting of circulation areas in the art galleries were put into consideration when designing.

The ventilation in the exhibition space perception responses indicates that 7.6% of the respondents are highly unsatisfied, 12% are unsatisfied, 25% are undecided, 40.2% are satisfied and 13% are highly satisfied with the ventilation in the exhibition spaces. From the result, as seen in table 4.3 majority of the respondents are satisfied with the ventilation of the exhibition space, which indicates that the ventilation

of the exhibition halls was considered when designing the art galleries.

Sufficient circulation in the exhibition spaces was also a question. 4.3% of the respondents are highly unsatisfied, 17.4% are unsatisfied, 31.5% are undecided about their perception of circulation in the exhibition spaces, 37% are satisfied, 9.8% are highly satisfied. The result from table 4.3 shows that a significant amount of the respondents are satisfied with the circulation, be as it may 31.5% are also undecided; thus a proper consideration should also be put in designing better circulation area for art galleries.

Visual comfort in exhibition spaces shows the percentage of highly unsatisfied respondents is 4.3%, unsatisfied is 5.4%, undecided is 26.1%, 54.3% are satisfied while 9.8% are highly satisfied. A significant percentage of respondents indicate that they are satisfied with the visual comfort.

The heating, cooling and ventilation system is investigated among the respondents. It indicates that 3.3% are highly unsatisfied, 12% are unsatisfied, 37% are uncertain, 32.6% are satisfied, while 15.2% are highly satisfied with the HVAC system. This indicates that the HVAC system is sound, but it can be improved. Thus, consideration should be put in designing art galleries.

The temperature inside the building shows that the percentage of the highly unsatisfactory respondents is 3.3%, 18.5% unsatisfied, 34.8% uncertain, 35.9% are satisfied, and 7.6% are highly satisfied. The air quality inside the building also shows that the percentage of respondents that are highly unsatisfactory 3.3%, 18.5% are unsatisfied, 34.8% are uncertain, 35.9% are satisfied while 7.6% are highly satisfied. As seen in Table 4,3 above, the respondents are satisfied with the temperature and indoor air quality of the art galleries. This shows that the temperature and air quality were considered when designing.

**Table 4.4:** Descriptive statistics of related daylighting problems

Variables	N	Mean	Std. Deviation
Visual comfort in exhibition spaces	92	3.60	.902
Visibility of the objects displayed	92	3.57	1.051
The lighting of the circulation and exhibition space	92	3.46	1.063
The heating, cooling and ventilation control in the building	92	3.45	.999
The air quality inside the building	92	3.41	1.039
Ventilation in the exhibition spaces	90	3.40	1.110
The illumination of the exhibition spaces	92	3.35	1.104

Sufficient circulation in the exhibition spaces	92	3.30	1.014
The temperature inside the building	92	3.26	.959
The glare in the exhibition space is desirable	92	3.24	1.010
The positioning of windows in the building	92	3.03	1.053
Valid N (listwise)	92		

Source: Authors' report (2020)

**Objective 3: Identifying lighting design strategies that influence user experience in art galleries**

The pertinent philosophy overdue daylight strategies were presented to the respondents to specify their level of the agreement under the liker scale of measurement. The results are presented below in table 4.5;

**Table 4.5:** relevant daylighting strategies

S/N	Variables	No of respondent	Strongly Disagree (%)	Disagree (%)	Undecided (%)	Agree (%)	Strongly Agree (%)
1	Proper lighting strategies foster active display of artefacts	92	3 (3.3%)	2 (2.2%)	11 (12%)	35 (38%)	41 (44.6%)
2	Proper considerations need to be placed on the lighting strategies to stop the deterioration of artefacts	92	4 (4.3%)	12 (13%)	25 (27.2%)	25 (27.2%)	26 (28.3%)
3	Vertical windows should be discouraged in exhibition spaces	91	10 (11%)	10 (11%)	49 (53.8%)	20 (22%)	2 (2.2%)
4	Clerestory windows should be adequately placed to encourage more natural light	91	3 (3.3%)	9 (9.9%)	37 (40.7%)	24 (26.4%)	18 (19.8%)
5	Top lighting should be encouraged in exhibition spaces	92	5 (5.4%)	5 (5.4%)	24 (26.1%)	29 (31.5%)	29 (31.5%)
6	The use of reflective panels should be encouraged	91	5 (5.5%)	2 (2.2%)	36 (39.6%)	31 (34.1%)	17 (18.7%)
7	The use of both natural light and artificial light will create better lighting conditions in the exhibition spaces	91	4 (4.4%)	6 (6.6%)	20 (22%)	23 (25.3%)	38 (41.8%)
8	The illumination system is adequate	88	5 (5.7%)	12 (13.6%)	34 (38.6%)	29 (33%)	8 (9.1%)

Source: Authors' report (2020)

The respondents' perception on how active display of artefacts is achieved with proper lighting strategies as realized in table 4.5 shows 3.3% strongly disagree with that perception, 2.2% disagree with that thought 12% are undecided about their thought, 38% of the respondent agree, and 44.6% strongly agree with the idea that proper lighting helps in achieving active display of artefacts. A significant proportion agreeing to the adjustable signifies the necessity to have a proper reflection in the lighting strategies in the exhibition spaces.

The respondents were further asked for their perception on placing proper lighting strategies to stop the deterioration of artefacts 4.3% of the respondent strongly disagree, 13% of the respondent disagree, 27.2% are undecided, 27.2% are also in agreement with the idea, 28.3% agree with the idea of placing proper lighting strategies to prevent artefacts from deteriorating. The percentage of respondent's agreement indicates the importance of having proper lighting strategies in art galleries.

The use of vertical windows in exhibition spaces is very critical in exhibition spaces. 11% of the respondent strongly disagree with the idea of discouraging the use of vertical windows, 11% disagree with this notion, 53.8% are undecided, 22% of the respondents agree while 2.2% strongly agree. A significant percentage of respondents are uncertain about their perception of the discouraging the use

of vertical windows in exhibition spaces. This indicates that making use of vertical should not be discouraged, but it can be improved. Vertical windows can be designed the fit the exhibition spaces.

The respondents view on encouraging natural lighting with the use of adequately paced clerestory windows as seen in table 4.5 shows that 3.3% and 9.9% of the respondents strongly disagree and disagree respectively, 40.7% are uncertain, 26.4% agree, 19.8% strongly agree with the idea. From the result in table 4.5 above, making use of clerestory windows to achieve more natural lighting should be critically considered when designing art galleries.

The respondent's response on the use of top lighting in exhibition spaces as seen in table 4.5 above shows 5.4% strongly disagree, 5.4% disagree, 26.1% undecided, 31.5% agree and 31.5% strongly agree. This result signifies the need for the infusion of top lighting in exhibition spaces. Furthermore, the respondents were asked for their perception of making use of reflective panels in exhibition spaces. 5.5% of the respondents strongly disagree, 2.2% disagree, 39.6% of the respondents are undecided, 34.1% agree with the notion, 18.7% strongly agree. Thus, the use of reflective panels should be encouraged to achieve proper lighting in exhibition spaces.

The respondent view about the amalgamation of both natural light and artificial light to generate better lighting settings indicates that 4.4% strongly disagrees, 6.6% also disagrees, 22% are undecided, 25.3% of the respondents

agreed, and 41.8 % strongly agreed. The high percentage of agreement motivates the need merging both lighting strategies effectively for better light conditions. On their perception on the adequacy of the illumination system, the respondents that strongly disagree are 5.7%, those that disagree are 13.65, those that are undecided are 38.6%, those that agree and strongly agree are 33% and 9.1% respectively. This specifies the indispensable need for reflection on the illumination system in art galleries.

**Table 4.6:** Descriptive statistics of relevant daylighting strategies

Variables	N	Mean	Std. Deviation
Proper lighting strategies foster capable display of artefacts	92	4.18	.960
The use of both natural light and artificial light will create better lighting conditions in the exhibition spaces	91	3.93	1.143
Top lighting should be encouraged in exhibition spaces	92	3.78	1.118
Proper considerations need to be placed on the lighting strategies to stop the deterioration of artefacts	92	3.62	1.156
The use of reflective panels should be encouraged	91	3.58	1.001
Clerestory windows should be adequately placed to encourage more natural light	91	3.49	1.026
The illumination system is adequate	88	3.26	1.000
Vertical windows should be discouraged in exhibition spaces	91	2.93	.929
Valid N (listwise)	85		

Source: Authors' report (2020)

As seen in Table 4.6, the highest mean value at 4.18, indicating proper lighting strategies fosters active display of artefacts while the lowest mean value at 2.93, indicating vertical windows should be discouraged in exhibition spaces. This indicates that natural lighting can be achieved with the use of other lighting strategies in art galleries without the use of vertical windows in these buildings.

## Discussions

These results signify that more natural lighting should be considered in the designing of exhibition halls. It can, however, be inferred from Avila (2009), Mayowa (2015) & Lowe (2009), that natural lighting in exhibition spaces is of importance in achieving positive user experience, and should always be considered when designing exhibition spaces. According to Avila (2009), positioning and shape of fenestrations are significant in contributing to the daylighting of an art gallery, it can be inferred from the result above that positioning of fenestrations and glare in

exhibition space are undesirable, and they affect the experience of the users within the space

Aderonmu, Adesipo, Erebor, Ediae, & Adeniji, (2019) stated in their findings that the use of both natural light and artificial light would create better lighting conditions in the exhibition spaces, and top lighting should be encouraged as it aids effective display of artefacts and it enhances user experience. The above statement is in cognizance, with the result gotten from respondents. Hence, the use of both natural light and artificial light, and top lighting should be encouraged in exhibition spaces. Alrubaih et al. (2013) also mentioned top light windows, and anti-solar windows help foster effective lighting within a space, which is in cognizance with the response of the respondent concerning relevant features that can be integrated into designing art galleries.

In conclusion, it can be inferred from Table 4.2; natural lighting should be considered in art galleries. From table 4.4, it can be inferred that lighting plays an essential role in the visual comfort and visibility of artefacts in art galleries. As seen in table 4.6, lighting strategies foster an active display of artefacts. It can be inferred from all result above that lighting plays essential roles in influencing user experience in art galleries.

## Conclusion and Recommendations

Lighting strategies are essential in exhibition space; thus, this project was aimed at assessing lighting strategies and their influence on the users of selected art galleries. In assessing the lighting strategies and their influence on user experience in art galleries, it is imperative to lay out a concrete framework by which parameters of lighting strategies that affect user experiences such as side lighting, top lighting and clerestory lighting. Famous works of literature reviewed showed lighting strategies used in art galleries. Further research was carried out to find out the impact of these strategies on user experience with the use of questionnaires from which relevant data were gathered and inferred. Conclusively natural lighting should be considered in designing exhibition spaces. In other to achieve this natural lighting without hurting the users, positioning of the opening should be carefully considered. In conclusion, lighting strategies used an exhibition space affects the experience of users. Thus, designers should put into consideration the user experience when designing an exhibition space.

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