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Evaluation of Lighting Levels and their Impact on User Comfort in a Muslim Prayer Room at Residential Colleges, Pagoh

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Abstract

Adequate lighting is essential to ensure visual comfort and support users' spiritual concentration (khushu') during prayer and Qur'an reading activities. This study was carried out at a residential college prayer room in the Pagoh to assess the current lighting levels and their effects on user comfort. The objectives of this study were to evaluate users' visual comfort in the prayer and reading areas, measure and compare the illuminance levels with the recommended standards and propose practical lighting improvement strategies. A mixed-method approach was adopted, combining questionnaire surveys to assess users' perceptions with quantitative field measurements using a lux meter. The findings reveal a significant gap between the existing lighting levels and the specifications outlined in the MS 1525 (2014) Only average values between 43 and 92 lux were recorded by the current artificial lighting system, which is significantly less than the ideal recommended standard of 200 lux for prayer rooms. According to the questionnaire analysis, which is consistent with these physical data, the majority of respondents (72.7%) reported experiencing visual discomfort as a result of the gloomy surroundings and uneven light distribution, which led to eye strain and distributed concentration. The report suggests a number of tactical solutions to deal with these problems, such as switching to energy efficient LED lighting, altering the fixture arrangement to remove dark areas, carrying out regular maintenance, and offering targeted task illumination in the reading zones. All things considered, it is anticipated that these empirical results will help residential college facility management implement user-centric lighting improvements for the congregation's overall comfort and well-being.

1. Introduction

Light is an essential component that shapes the built environment and is vital to the overall quality of indoor spaces as well as their aesthetics. Despite the fact that it is frequently linked to scientific and economic growth,

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others believe it may restrict to scientific and economic growth, others believe it may restrict artistic creativity. In order to produce significant psychological effects, light is still a vital tool for artists (Armaghan & Servatju, 2014). Lighting has a major impact on human health, comfort, productivity, and self-esteem in addition to its aesthetic appeal. The quality of lighting becomes even more crucial as modern lives force people to spend more time indoors in areas like offices and classrooms. In addition to increasing productivity and quality of work, well-designed lighting can promote comfort and wellbeing (Krawczyk & Dębska, 2022a).

Each place benefits from lighting that is appropriate for its particular purpose, which also promotes relaxation. For instance, bad decisions can result in unfavorable outcomes like hostility or extreme exhaustion. Poor illumination can negatively affect physical and mental well-being. Appropriate lighting conditions can be adjusted according to users' needs to create a more comfortable and supportive indoor environment. In the end, a well-planned interior space with suitable lighting can significantly enhance general quality of life and everyday productivity (Armaghan & Servatju, 2014).

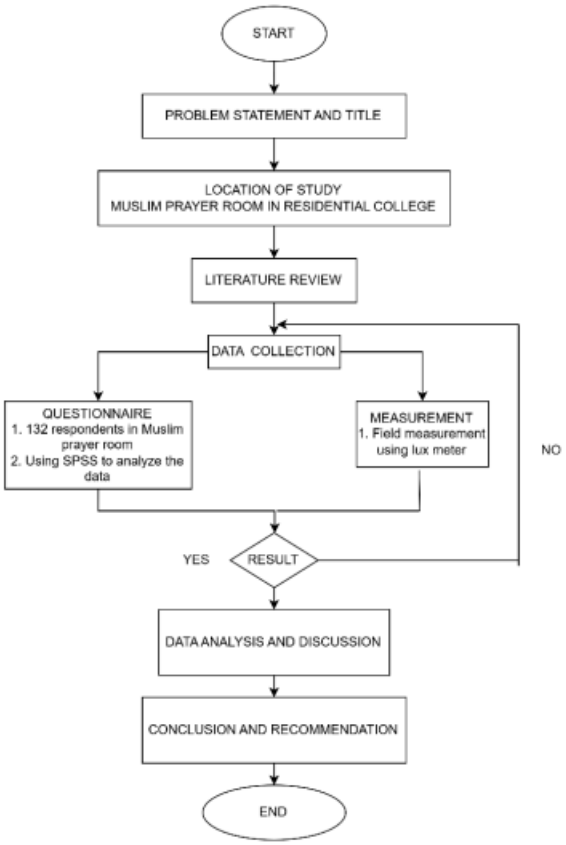
Lighting has a direct impact on people's activities and is essential to ensure their comfort. Careful control over lighting qualities, such as making the most of daylight and choosing artificial lighting that accurately depicts colors, is necessary to achieve a balanced distribution of natural and artificial light. In order to reduce problems like glare and adhere to basic lighting regulations, it also entails maintaining consistent illumination levels (Ameen et al., 2021a).

Despite the importance of adequate lighting for visual comfort, limited attention has been given to lighting conditions in Muslim prayer rooms within residential college environments. Prayer rooms are used for various activities, including prayer, Qur'an reading, and other religious activities that require adequate visual conditions. Therefore, evaluating both the physical illuminance levels and users' perception is important to determine whether the existing lighting conditions provide an appropriate and comfortable environment.

Therefore, this study evaluates the lighting levels and their impact on user comfort in a Muslim prayer room at a residential college in Pagoh. The study combines field measurements using a lux meter with questionnaires-based assessment to compare objective lighting conditions with users' perceptions.

2. Method

Figure 1 presents the research methodology adopted in this study. The research process consisted of five main stages: problem identification, literature review, data collection, data analysis, and formulation of conclusions and recommendations. Data were collected using two approaches: questionnaire surveys to assess users' perceptions of lighting comfort and field measurements using a lux meter to determine illuminance levels at selected measurement points.



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Fig 1: Flowchart of the Methodology

2.1 Equipment

A lux meter used to measure illuminance levels within in the Muslim prayer room. The instrument was used to obtain quantitative measurements of the lighting conditions at the selected measurement points.

2.2 Method

2.2.1 Field Measurement

This study used two methods: questionnaire surveys with 132 respondents and data analysis using SPSS. Employed for statistical analysis of questionnaire surveys. Used for descriptive statistics, cross-tabulation, and generating visual representations of the collected data. The second method is field measurements with a lux meter. The lux meter was used to measure illuminance levels at selected points within the Muslim prayer room. This device conforms to standard MS1525:2014. Figure 2 shows the lux meter used to conduct the field measurements.



Fig 2: Lux Meter

2.2.2 Field Measurement

Procedure:

The measurement points were determined using the room index method. The room index was calculated using the following equation:

Room Index = (L X W)/(Hm x (L+W)).

Where L is the room length, W is the room width, and H is the mounting height above the measurement plane. Based on the calculated room index, the prayer room was divided into equally sized measurements grids to obtain representative illuminance measurements throughout the space.

Table 1: Minimum number of measurement points for measuring average illuminance in rooms of different proportions

Room Index	Number of measurement points
Below 1	4
1 and below 2	9
2 and below 3	16
Above 3	25
Room Index	Number of measurements points

Measurement: Measurements were taken using a lux meter at three specified times 8:30 am, 12:00 pm, and 9:00 pm

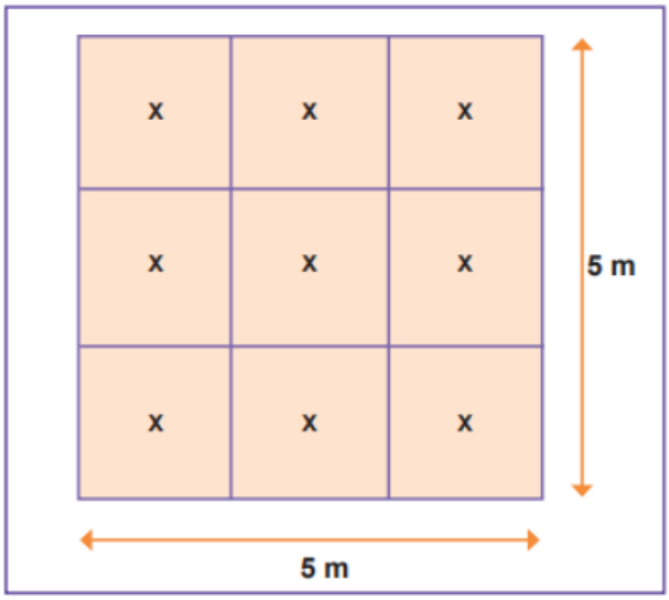


Fig 3: Lighting measurement at the center of equally divided squares

2.2.3 Questionnaire Surevey

A questionnaire was used to collect data on users' comfort levels and perception of the lighting in Muslim prayer rooms. A total of 132 respondents participated in the questionnaire survey. The respondents consisted of residential college students and staff who regularly used the Muslim prayer room for daily prayers and other religious activities. For instance, if the Muslim prayer room can accommodate 200 people at once, the responder sample was selected proportionately to reflect the real user population. This survey was completed by residential college staff and students who regularly utilize the prayer room for daily prayers. They were chosen because they have personal experience with the lighting configuration and can provide informed feedback regarding their level of comfort and satisfaction. Part A collected demographic information about the respondents, while Part B assessed their perceptions of visual comfort under natural and artificial lighting conditions. A five-point Likert scale was used for the closed-ended questions, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

2.2.4 Statistical Package for Social Sciences (SPSS)

Statistical Package for the Social Sciences (SPSS) was used to organize and analyse the questionnaire data. Descriptive statistics and cross-tabulation were used to summarize the respondents' perceptions of lighting conditions. Finding patterns or groupings in the data, doing cross-tabulations, and determining correlations were all made possible by SPSS. The Likert Scale, which is predicated on the idea that attitudes can be statistically assessed along a linear scale ranging from strongly disagree to strongly agree, was also employed as a crucial assessment tool. Pre-coded response alternatives, including neutral middle, were usually provided to respondents, enabling a range of perspectives between agreement and dissent.

3. Data and Result Analysis

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This section presents the results obtained from the field measurements and questionnaires survey. The field measurements results were used to evaluate the illuminance levels within the prayer room, while the questionnaire results were used to assess users' perceptions of visual comfort.

3.1 Field Measurement Analysis

The illuminance measurement obtained from the Muslim prayer room were analysed to assess the existing lighting conditions and determine their compliance with the recommended illuminance level specified in MS 1525 (2014). Measurements were taken at multiple points within the prayer room during different times of the day to capture variations in both natural and artificial lighting. The data were processed using contour charts to visualize the distribution of light intensity across space.

The results revealed that the average illuminance levels ranged between 43 and 92 lux for artificial lighting, which is significantly below the recommended 200 lux standard for prayer areas as outlined in MS 1525 (2014**)**. The contour charts further indicated that brightness was concentrated near openings such as doors and windows, while the central areas of the prayer room remained dim. This uneven distribution of lighting created zones of discomfort, particularly during reading and prolonged prayer activities.

Overall, the findings demonstrate that the current lighting system does not meet the minimum requirements for visual comfort. The insufficient and uneven lighting contributes to eye strain, reduced concentration, and dissatisfaction among users, highlighting the urgent need for improvements in fixture arrangement and lighting technology.

3.1.1 Data Collection of Field Measurement Analysis

The contour chart illustrates the spatial distribution of illuminance across the prayer room. Higher illuminance levels were observed near the openings, particularly around the doors and windows, while lower illuminance levels were observed in the central areas. This indicates that the existing lighting system does not provide uniform illumination throughout the prayer room.

Overall, the contour charts confirmed that the existing artificial lighting system fails to provide uniform and sufficient illumination. The lack of compliance with the standard contributes to visual discomfort, eye strain, and reduced concentration among users, emphasizing the need for lighting upgrades and fixture repositioning to achieve better uniformity and comfort.

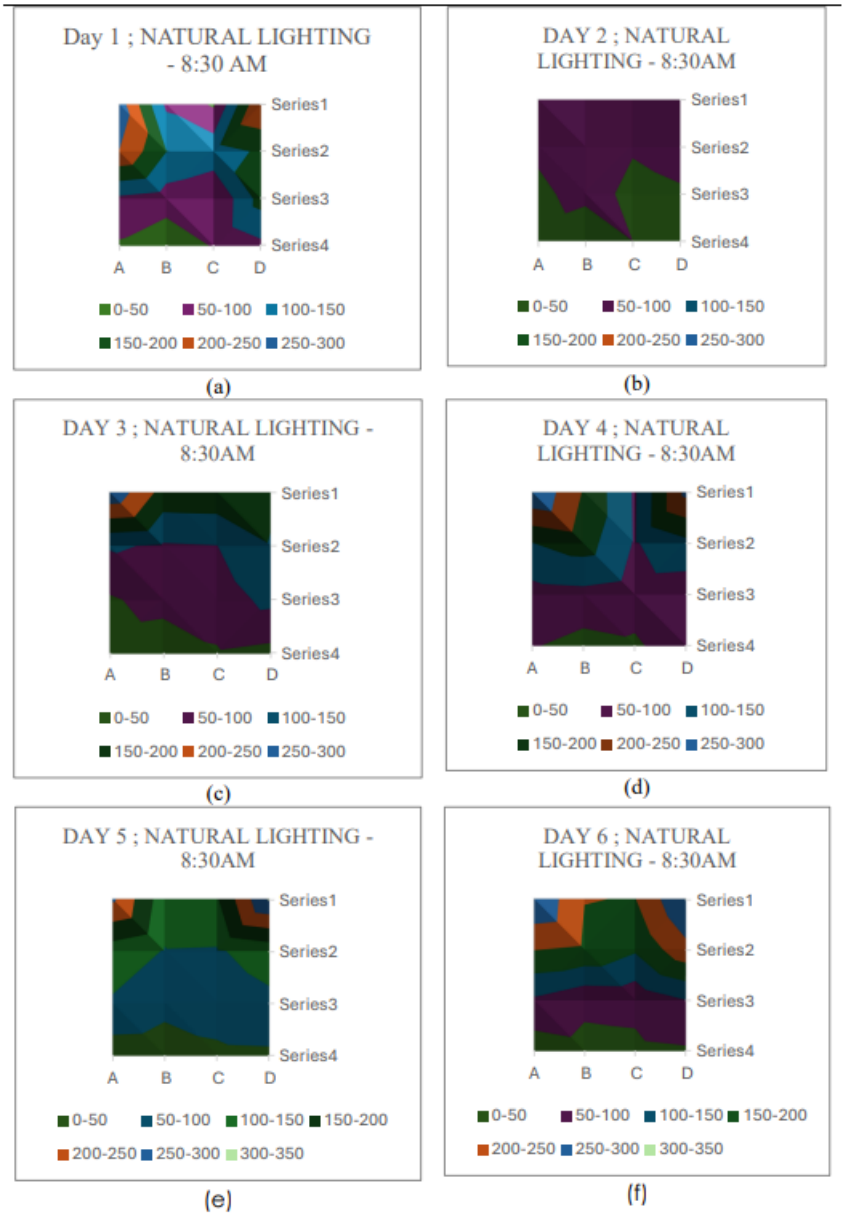


Fig 4: Data Collection of field measurement by using a contour chart graph

3.1.2 Data Collection of Questionnaire Survey Analysis

A total of 132 respondents completed the questionnaire survey. The respondents consisted of students and staff who regularly used the Muslim prayer room at the residential college. Analysis of respondents completed the questionnaire distributed of visual comfort concerning lighting was conducted at 8:00 am, 12:00pm, and 9pm.

Table 2: Cronbach's Alpha value for this study

Part B	Cronbach's Alpha	No. of items	Strength of Association
Natural Lighting	0.884	2	Very Good
Artificial Lighting	0.927	2	Excellent
Total Value	0.91	4	Excellent

The reliability analysis conducted using SPSS produced an overall Cronbach's alpha value of 0.91, indicating a high level of internal consistency among the questionnaire items. Thus, this indicates that the questions posed to the respondents are very good and effective with a high level of consistency. Table 2 shows the reliability value by part, namely Part B (0.884) and Part C (0.927).

4. Discussion

The field measurement results indicate that the existing lighting conditions in the Muslim prayer room are insufficient when compared with the recommended illuminance level specified in MS1525 (2014). The measured illuminance values also showed an uneven distribution across the prayer room, with higher levels observed near openings and lower levels in the central areas. The variations suggests that the existing lighting arrangement does not provide uniform illumination throughout the space.

The questionnaire findings support the field measurement results, as a substantial proportion of respondents reported visual discomfort under the existing lighting conditions. The relationship between the measured illuminance levels and users' perception indicates that inadequate and uneven lighting may affect visual comfort during prayers and Qur'an reading activities. These findings are consistent with previous studies highlighting the importance of appropriate indoor lighting for visual comfort and user well-being. Adequate and evenly distributed lighting can reduce visual strain and create a more comfortable indoor environment. In the context of a Muslim prayer room, sufficient illumination is particularly important because users may engage in activities such as Qur'an reading that require adequate visual conditions.

The findings therefore suggest that improvements should focus not only on increasing the overall illuminance level but also on improving the uniformity of light distribution. Repositioning existing fixtures, upgrading the lighting system, and providing additional lighting in areas with insufficient illumination may improve the visual comfort of users.

5. Conclusion

This study successfully achieved its objectives by evaluating the lighting performance and its impact on user comfort in the Muslim prayer room at the residential colleges in Pagoh. Field measurements using a lux meter revealed that the average illuminance levels ranged between 43 and 92 lux, which is significantly below the recommended 200 lux standard outlined in MS 1525 (2014). The contour chart analysis further showed uneven distribution of lighting, with brightness concentrated near openings while the central zones remained dim.

The questionnaire findings further indicated that inadequate and uneven lighting was associated with visual discomfort, eye strain, and reduced concentration among users. Together, the objective measurements and subjective responses indicate that improvements to the existing lighting system are necessary to enhance visual comfort in the prayer room.

Overall, the study demonstrates that the current lighting arrangement does not meet the minimum requirements for visual comfort, thereby affecting the worship experience and reading activities of users. The results emphasize the importance of upgrading to energy-efficient LED fixtures, optimizing fixture placement, and implementing regular maintenance to ensure a comfortable and conducive environment for prayer and spiritual focus.

6. Recommendation

To improve the lighting quality and enhance user comfort in the Muslim prayer room at the residential colleges in Pagoh, several interventions are necessary. Firstly, the existing fluorescent lighting system should be evaluated for replacement with energy-efficient LED fixtures. The proposed LED system should be selected based on the required illuminance level and appropriate light distribution to ensure adequate and uniform illumination throughout the prayer room.

Additional task lighting may be considered in designated reading areas where higher visual requirements are needed for Qur'an and related activities. Furthermore, the integration of daylight-harvesting techniques and smart controls is recommended to maximize natural lighting during the day and reduce reliance on artificial sources. Finally, a routine maintenance schedule should be established to replace aging lamps, clean fixtures, and check electrical performance, ensuring sustained compliance with MS 1525 standards. Collectively, these recommendations aim to transform the prayer room into a user-centric, visually comfortable, and energy-efficient environment that supports spiritual focus and overall, well-being.

Acknowledgement

This section is compulsory. Acknowledgement and Reference heading should be left justified, bold with the first letter capitalized, but have no numbers. Text below continues as normal. Example, communication of this research

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Author Contribution

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results and manuscript preparation.

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