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# Assessment of Natural Lighting at the Interior Part of G3 Classroom

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**Abstract**: Classroom is a place where every student use in their daily life for various purpose related to education. Being the most used room it is important for the room to provide good visual comfort for the educators and students. There were a lot of classes are used in a day especially in university nowadays. Most of the are using artificial light as their main source of room lighting. A huge number of classroom will used up tremendous energy to provide the best illumination for reading and writing usage. Therefore to reduce the waste of energy, it is brilliant to utilize the natural lighting to illuminate the interior part of the building. This study was carried out to assess the natural lighting in the classroom of G3 in UTHM as sample for any other classes. The level of natural lighting is assess and compared to standard requirement guideline provided OSH. Based on the finding conducted at 10 classrooms around the G3 building at 4 different time the highest illumination recorded was168 lux which is nowhere near the standard illumination required which 500 lux. From this we have learn that G3 classroom need artificial lighting to illuminate the interior part of the building. In order to utilize the natural lighting in G3 building some modification is required to gain the efficient natural light.

**Keywords**: Natural Lighting, Visual Comfort, Energy-Saving, Comparison

## 1. Introduction

Lighting is very crucial in our daily life. With the presence of good light source almost everything in our daily life can be done perfectly and smoothly. Most of building built nowadays uses artificial lighting as it main light source. This causes the excessive use of electricity even on daytime just to produce optimum lighting. According to (L. Edwards 2002) several property owners and architects have reported energy savings from natural lighting. Of the multiple elements that affect the occupants of the building, light tends to have the most significant impact. Light is a human essence, and it is understood to have physical, biochemical, and psychological influences.

Generally, the daylight has been given freely to the universe and it is a universal element used in sustainable building design. Energy efficiency and environmental issues have improved these activities in recent years, and lighting has once again become an important element in building architecture.

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Besides the use of natural lighting should be optimize so that the building occupants can gain comfort to perform daily life. Without the presence of daylight, the interior part of the building would be as dark as the night time especially in enclosed area with less opening that allow the sunlight to come through. According to (N. Shishegar 2016) a number of studies have also shown that daylight influences the wellness and success of children. In schools and that with the aid of natural light, students' health, happiness, focus and, ultimately, performance are increased in classrooms. With that being said it is important to maximize flow of natural lighting into the interior of the building while designing the building as especially related to study area would increase the characteristics and durability of asphalt binder while also being cost-effective and environmentally beneficial.

## 2. Natural Lighting in Classroom

Natural lighting, also known as day lighting, is a strategy that uses outdoor glazing (windows, skylights, etc.) to effectively introduce natural light into your home, thereby reducing artificial lighting requirements and save energy. It has been shown that natural lighting improves the level of well being and comfort for building residents. Day lighting architecture science is more difficult than just getting light into a home. You must consider juggling heat gains and losses, glare management, and differences in daylight availability when installing a daylight fixture. In addition, it is important to note window size and spacing, glass selection, the reflection of interior finishes, and the placement of interior partitions.

Among the factors are the orientation of the building, openings, shading, color building and building design (Ashraf, 2008). With an emphasis on the element-this element, the interior lighting well adaptable. Building design referring the arrangement of the interior part of the building, floor layout and the number of building storey. From the sources, (Brown, 2017) the very optimum height of the windows is in between 30 to 90 inches from floor. The sight distance from the building to the exterior In compliance with the Requirement for the Lighting Design of Buildings

(GB50033-2013), the lighting of the classroom and open indoor shelf should not be lower than Grade III, in which lighting should be provided. Be well lightened to satisfy the accuracy criteria of the job. As far as side lighting is concerned, the normal value. The daylight factor is 3% and the normal value of natural light strength in reading space is 450 lux.part of the building are good for eyes health is in between 50 feet or more.

## 3. Material and Method

### 3.1 Observation

Observations and survey on the study location should be conducted to obtain more accurate information related to the problem environment and location appropriate to the topic of the study. For this study, 10 classroom in G3 was selected. All 10 classroom are located at various point of the building. From that the overall review lighting performance of the building can be obtained.

### 3.2 Measurement

Reading on lighting will be obtain by using the 4inl Meter Kit. Based on the source (Michael Wangsa, 2015), the tool will be placed at several points in the classroom. For this study the point of data recorded is around 3.5m from every corner in the classroom which is 4 points then later the average of 4 value is recorded Lighting data is taken manually at the set point and at 4 different times i.e. 8 am, 1 1 am, 2 pm, 5 pm. As such, the retrieval of lighting data considers the peak time aspect where at 4 hours is the appropriate time to conduct a study to obtain more data related to the objectives of the study.

The 4in1 meter Kit is the main tool used to get the lighting level value for each point or location that has been set. The values of wind speed, temperature humidity and light will be taken at each point that has been set. The analysis obtained involved the lighting test results on the interior space of the classroom. The analysis processed in this study involves measuring the value of light using 4in1 Meter Kit at each point that has been set in the classroom. Based on the values obtained, it will be presented

using the appropriate graph or diagram. To facilitate the understanding of the analysis of this study, the orientation of the natural lighting through the sunlight orientation is presented by using sketchup software.

## 4. Result and Discussion

### 4.1 Data of testing

**Table 1: Lightning Data (LUX)**

| Class/Time | 8AM | 11AM | 2PM | 5PM | Average daily Lighting |
|---|---|---|---|---|---|
| BKE3 | 24 | 49 | 61 | 46 | 45 |
| BKE4 | 19 | 54 | 89 | 62 | 56 |
| BKE5 | 22 | 86 | 132 | 37 | 70 |
| BKE6 | 31 | 91 | 139 | 62 | 81 |
| BKE7 | 51 | 110 | 144 | 46 | 88 |
| BKB1 | 34 | 75 | 74 | 45 | 57 |
| BKB2 | 31 | 61 | 62 | 36 | 48 |
| BKB3 | 58 | 106 | 93 | 48 | 77 |
| BKB4 | 74 | 156 | 124 | 62 | 104 |
| BKB7 | 89 | 136 | 161 | 64 | 113 |
| Average lighting performance | 45 | 115 | 125 | 49 | |

**Table 2: Temperature Data (°C)**

| Class/Time | 8AM | 11AM | 2PM | 5PM |
|---|---|---|---|---|
| BKE3 | 29.5 | 31.3 | 32.2 | 33.6 |
| BKE4 | 29.3 | 31.0 | 33.1 | 33.7 |
| BKE5 | 29.5 | 31.4 | 33.6 | 33.7 |
| BKE6 | 29.1 | 32.6 | 33.0 | 33.1 |
| BKE7 | 29.6 | 32.9 | 33.2 | 33.4 |
| BKB1 | 30.0 | 32.7 | 33.6 | 33. |
| BKB2 | 30.0 | 32.6 | 33.4 | 33.6 |
| BKB3 | 30.2 | 32.9 | 33.1 | 33.2 |
| BKB4 | 30.1 | 32.4 | 33.4 | 33.2 |
| BKB7 | 30.3 | 32.0 | 32.9 | 33.5 |
| Average room temperature | 29.8 | 32.2 | 33.2 | 33.4 |

Table 1 and 2 above shows the data on lighting and temperature respectively on every classroom taken at 4 different time. Based on table 4.1 the lighting data shows that classroom BKB7 has the highest natural lighting with average daily lighting 113 lux. The lighting data also shows that the data are recorded higher during 11a.m. and 2p.m. Meanwhile Table 2 shows the reading of the room temperature at 4 different time. The reading of the temperature keeps rising despite the illumination of daylight decrease at 5p.m. at average 33.4°C compared to 29.8°C in the morning.

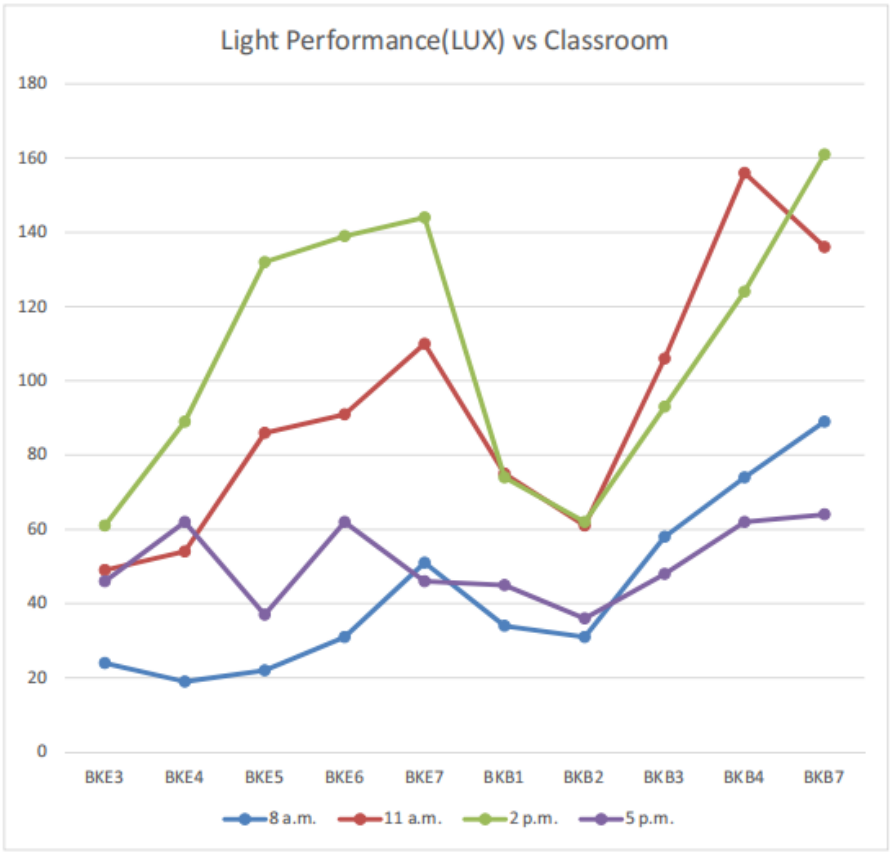


**Figure 1: Light performance (LUX) vs classroom**

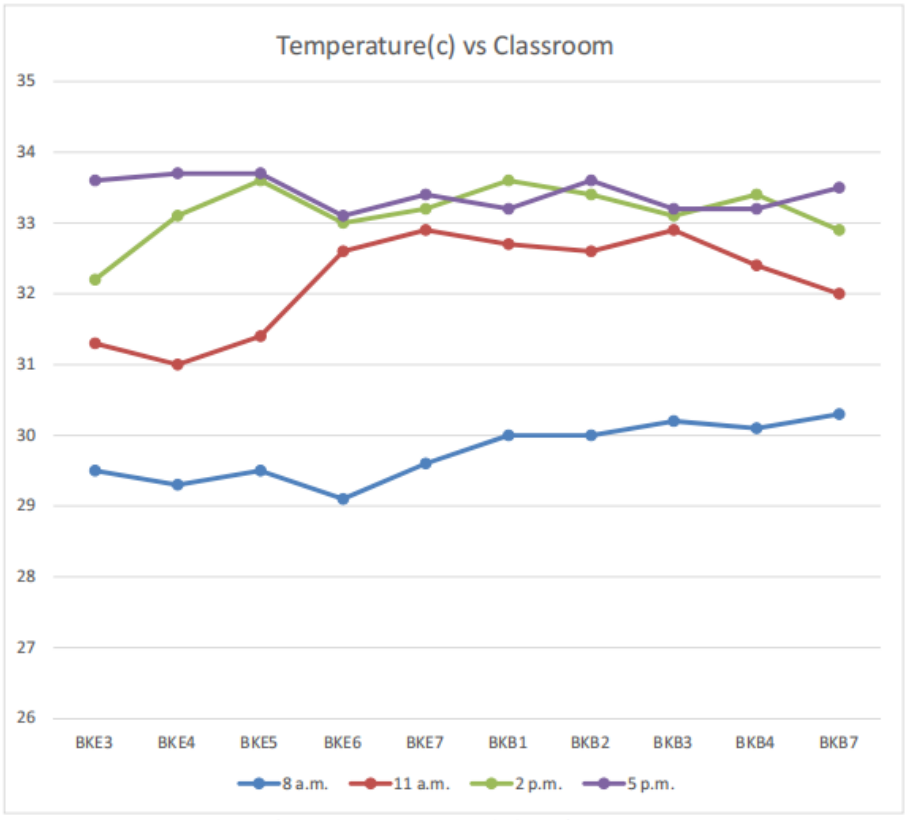


**Figure 2: Temperature (°C) vs classroom**

Figures 1 and 2 are data from Table 1 and 2 to show the significant trend and difference in the data obtained in every classroom. Based on Figure 1 and 2 the trend of graph shown is almost the same at every classroom where the reading of illumination at 8a.m. is lower than 11a.m., 2p.m. and 5 p.m. The graph trend for Figure 1 and 2 shows the peak at 11 a.m. and 2p.m. where the illumination provided are at best for interior usage especially education purpose. At 5p.m. both of the graph shows decrease value illumination at every classroom.

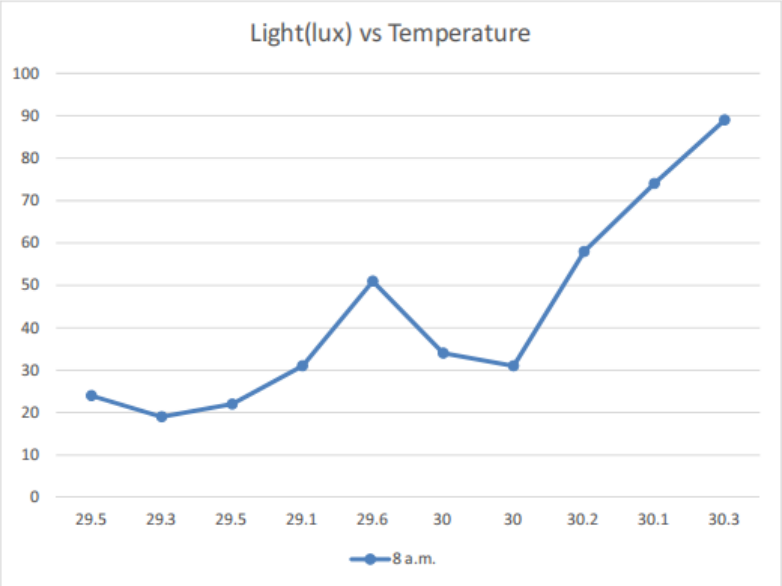


**Figure 3: Light vs Temperature in every classroom at 8 a.m**

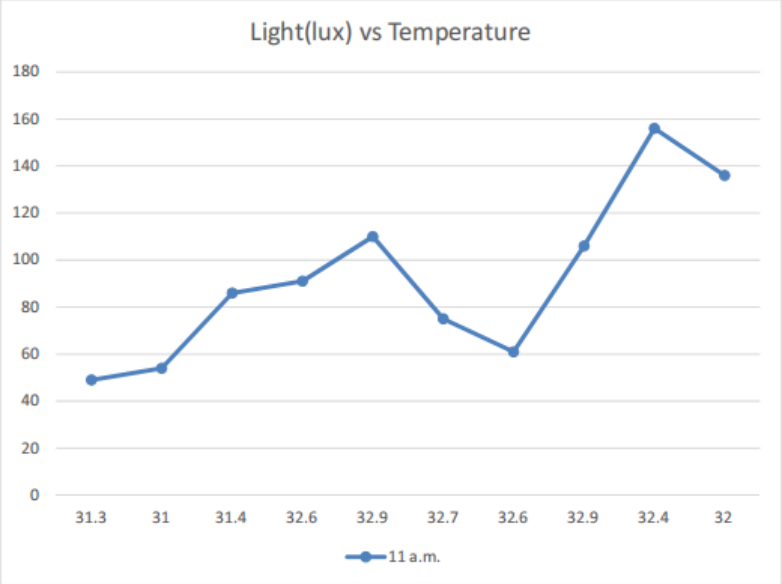


**Figure 4: Light vs Temperature in every classroom at 11 a.m**

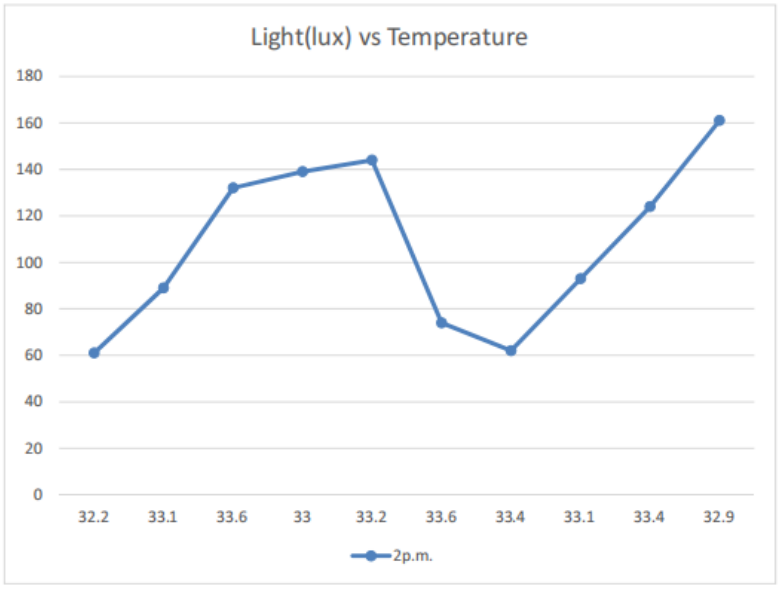


**Figure 5: Light vs Temperature in every classroom at 2 p.m.**

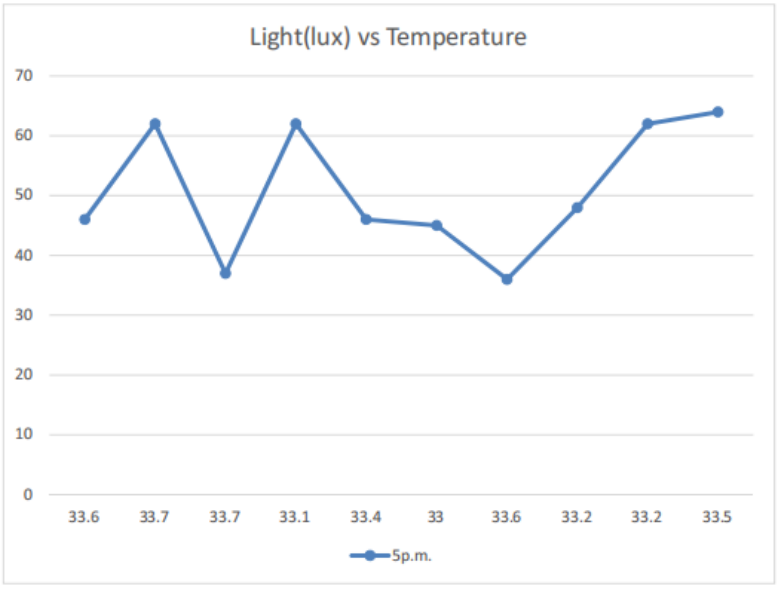


**Figure 6: Light vs Temperature in every classroom at 5 p.m.**

Figure 3, 4, 5 and 6 shows the graph of lights against temperature in every classroom at 4 respective time. Based on the figure above, the graphs at 4 different time show the same trend where the higher value of light increases the value of temperature. Thus, the temperature value at 4 times shows a value that seems to be the same at each measurement point even if the value of the illumination level shows a graph pattern which ascends and descends according to the distribution of light on the building. Based on the graph of light against temperature at every classroom, the value of light increases in parallel with the temperature value. However, at 5p.m. hours, the value of light decreases though the temperature value indicates the highest value.

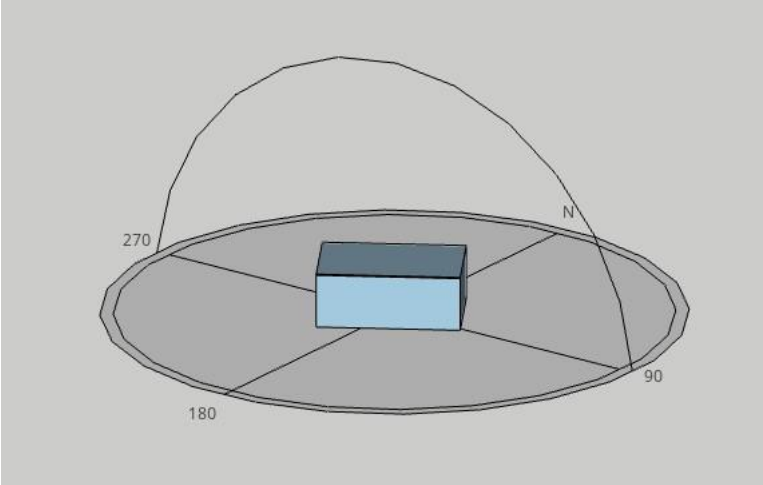


**Figure 7: G3 classroom orientation at 8 a.m., 11 a.m., 2 p.m. and 5 p.m**

Figures 7 is the G3 classroom orientation at 8 a.m., 11 a.m., 2 p.m. and 5 p.m. where lighting data were taken while conducting this study. The lighting value is low at 8AM

and 5PM as recorded in Table 4. 1. Based on the figures above, it shows the position of the building and the shadows influenced by the orientation of the position of the sun located in the East to West direction. Instead of having one side facing the east to west direction this building has two side of wall to face the sunlight at a time. Orientation the classroom involved are influenced by the path of the sun to optimize daylight lighting where it is known as a source of energy saving useful.

## 5. Conclusion

Based on the values of natural lighting obtained from all classroom it does not meet the standards set by CIBSE for maintain lighting in the range of 300-500 lux for a building. The illumination data obtained indicate the level of illumination nature still needs auxiliary light to illuminate the space. The classroom is a place where required to write and read. Therefore, according to the OSH area for reading requires 500 lux and 20 lux can only distinguish faces occupants who come to the class.

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