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The Study of Indoor Lighting Quality in UTHM Kampus Bandar Building

Juventus Evan Kimjus[1], Izudinshah Abd Wahab[1]*

[1]Faculty of Civil Engineering and Built Environment,
University Tun Hussein Onn Malaysia, Batu Pahat, Johor, 86400, MALAYSIA

*Corresponding Author Designation

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Abstract: Lighting is an important element for us to see and carry out our daily routine. As for a building, it is important to have both natural lighting and artificial lighting. For a studio room, it requires a high amount of lighting so that visual task can be conducted effectively. The purpose of this research is to identify the level of natural and artificial light in Universiti Tun Hussein Onn Malaysia (UTHM) Kampus Bandar building. Based on preliminary observation, it is found that the natural lighting system in the Kampus Bandar is inadequate and has to rely on artificial lighting. There are several factors that contribute to lighting problem such as inappropriate lighting levels, size and the location of the windows in buildings, and the surrounding of the building. By using the Lux meter tools, the building was studied in accordance from MS1525:2014. Data taken starting from 9.00am, 12.30pm, and 4.30pm so that it can be analyze and compared to MS1515:2014. The result shows that each studios has a different illuminance level based on different data are taken from 22 different points. Studio room illumination level is lower than the required illuminance level on MS1515:2014. However, the illumination level of the studio can be increased with additional of artificial light.

Keywords: Natural Light, Lighting System, Lux Meter, MS1525:2014

1. Introduction

Sun is the only main source of natural lighting. Whereas man made lighting is produced by heat and energy generated by mechanical and electrical system [1]. Natural lighting in building usually will go through the openings of the building to provide light in a room [2]. For artificial lighting, the building would have had to rely on artificial lighting. Lighting is a one of important aspects in a building because every room in a building must following the requirements based on MS1525:2014 which is 200Lx for normal room and 300Lx – 400Lx for studio room [3]. Every room must followed the minimum requirements because it would affect the performance of doing critical task [4]. Through preliminary observation, it was found that natural lighting system at Kampus Bandar space was expected inadequate and needed depends on artificial lighting. The amount of lighting needed to have been adequate so that it cannot disturb the activities in the room. Kampus Bandar was originally a business lot unit, now the

*Corresponding author: izudin@uthm.edu.my

placed was changed into a studio space. The lighting prerequisites between these various spaces were likewise different. So it was important to saw the effect of lighting now whether it was sufficient for studio used.

This study investigated the indoor lighting quality in Kampus Bandar building. The objective of this study is to investigate the illuminance level of indoor lighting system of studio room in Kampus Bandar building, and to compare the quality of indoor lighting of Kampus Bandar lighting and standard brightness that had been set which was MS1515.2014. In Kampus Bandar, it is important to make sure that the illuminance of studio room meet the minimum requirement so that students can perform their task effectively. This research was conducted to set a comparison between the illuminance level of the spaces with the standard in MS1515:2014.

2. Materials and Methods

To measure illuminance in a room. There are tools that are required to check either the room are based on minimum requirement of lux or not. There are three types of illuminance tools which is Lux meter, Spectrometer, and Integrated sphere. All these tools having the same function which is to measure light intensity. Based on this three tools, for location at Kampus Bandar it is suitable to use Lux Meter because it is easy to conduct and portable and method to conduct the tools is not complicated.

2.1 Research flow

Every room would be divided into several grid to check the illuminance level. There are several factor that can affect the reading so that it is conducted only during bright light condition. According to [4], it shows that the usage of both natural and artificial light must be balanced because too much illuminance in artificial and natural light can lead into glaring effect. For drawing room, the recommended average illuminance levels are within 300Lx to 400Lx. Based on Kampus Bandar, there are four studios that need to be focused which is: 1. Gallery – ground floor 2. Studio 3 – ground floor 3. Studio 2 – ground floor 4. Studio 1 – first floor There would be 22 points that need to be recorded based on the four studio, each studio will be divided into 6 points so that the data taken can be compared to the minimum illuminance requirement.

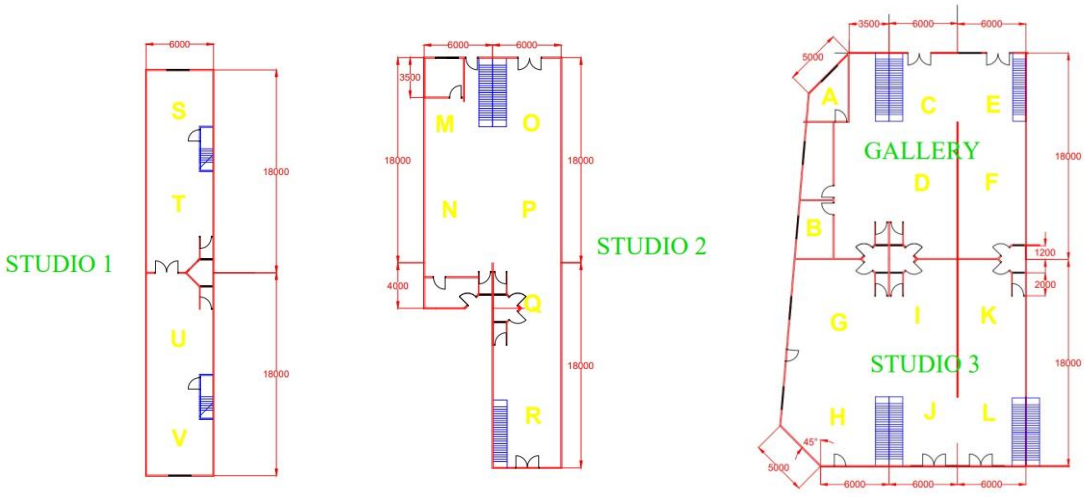

Figure 1 : Drawing plan of each studios in Kampus Bandar building

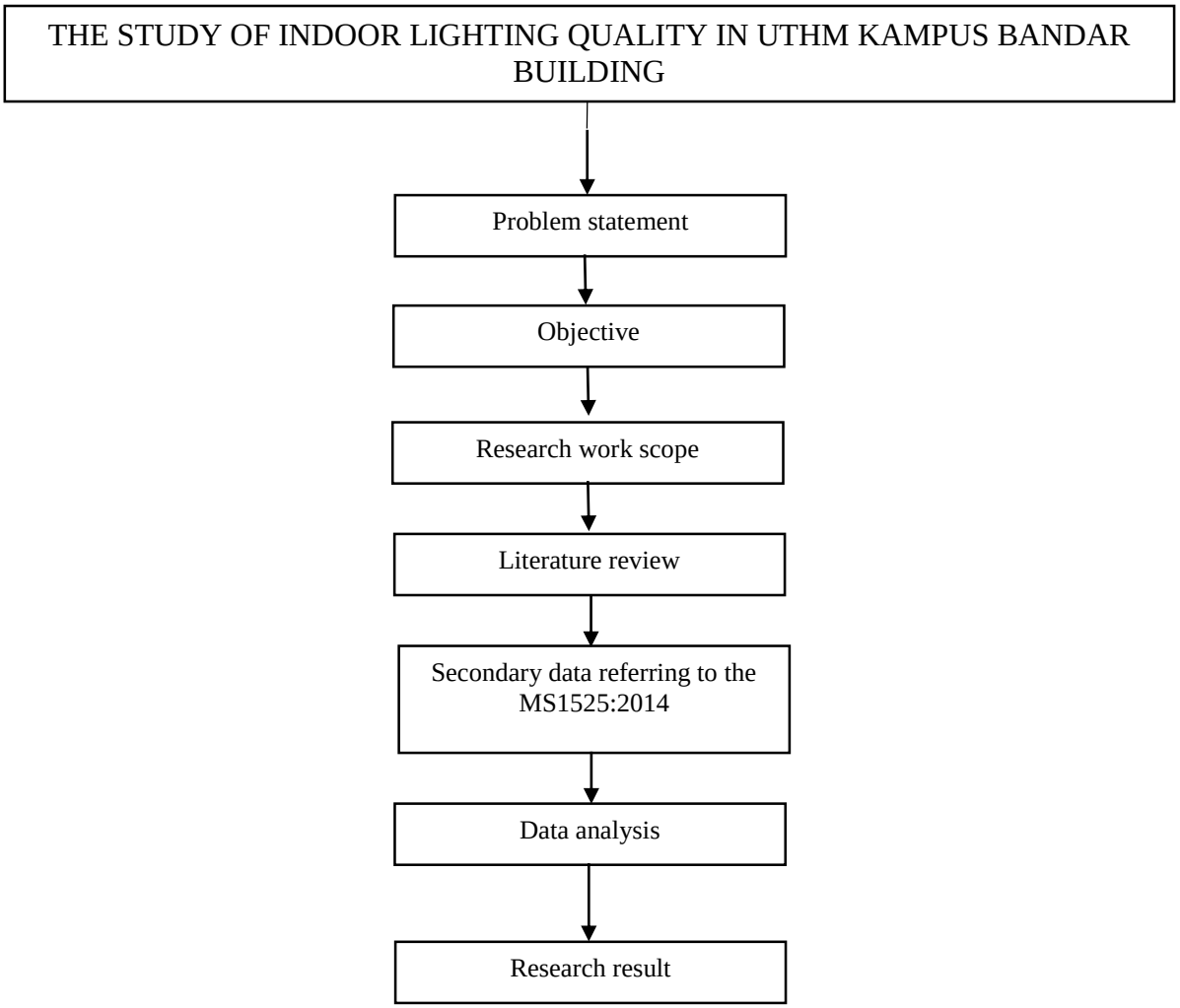

Figure 2: Research flow

2.2 Data analysis

To analyze every studio room in Kampus Bandar. Each space would be divided into several grid points. Every locations of the windows, partitions, door, and toilet will be drawn. Every reading would be taken using Lux Meter. The Lux Meter would be placed in each points and the data would be recorded and tabulated so it would saw the illuminance level of each points. The Lux Meter must have been placed at table or the waist height. The purpose of placing the Lux Meter in several points so that it will reduce the error during data collection [5]. Reading would be taken in three times, first reading would be taken during 9.00am, second reading during 12.30pm, and third reading is 4.30pm. Every data taken is only taken under bright light condition. Every data would be divided where there would have been data for natural light and artificial light in every room. For outdoor, similar method would be taken during 9.00am, 12.30pm and 4.30pm.

3. Results and Discussion

In this chapter, it would explained the analysis of the data that are taken during the research. The data would be compared into the MS1515:2014 and discussion would be made so that it can determine whether the lighting system in Kampus Bandar are suitable to be used as studio room or not. Accompanying discussions that further explained observations of the results are usually placed immediately below the results paragraph.

3.1 Result

Table 1: Illuminance data for each studio taken using Lux Meter

Data Lighting In Areas Of Kampus Bandar Block A & B					
	OUTDOOR READING	**9.00 AM** 1200 Lx	**12.30 AM** 8900 Lx	**4.30 PM** 6600 Lx	**With artificial Light**
LOBBY AND GALLERY (ground floor)	POINT A	120 Lx	100 Lx	80 Lx	230 Lx
	POINT B	80 Lx	80 Lx	80 Lx	250 Lx
	POINT C	120 Lx	100 Lx	90 Lx	360 Lx
	POINT D	80 Lx	60 Lx	60 Lx	300 Lx
	POINT E	110 Lx	90 Lx	80 Lx	360 Lx
	POINT F	80 Lx	60 Lx	50 Lx	280 Lx
STUDIO 3 (ground floor)	POINT G	90 Lx	90 Lx	110 Lx	250 Lx
	POINT H	90 Lx	90 Lx	110 Lx	300 Lx
	POINT I	90 Lx	90 Lx	90 Lx	190 Lx
	POINT J	100 Lx	100 Lx	160 Lx	200 Lx
	POINT K	90 Lx	90 Lx	120 Lx	200 Lx
	POINT L	100 Lx	120 Lx	180 Lx	200 Lx
STUDIO 2 (ground floor)	POINT M	80 Lx	70 Lx	50 Lx	180 Lx
	POINT N	70 Lx	70 Lx	50 Lx	120 Lx
	POINT O	90 Lx	90 Lx	80 Lx	240 Lx
	POINT P	50 Lx	60 Lx	50 Lx	200 Lx
	POINT Q	70 Lx	70 Lx	80 Lx	200 Lx
	POINT R	80 Lx	80 Lx	100 Lx	280 Lx
STUDIO 1 (first floor)	POINT S	80 Lx	70 Lx	80 Lx	120 Lx
	POINT T	70 Lx	70 Lx	80 Lx	100 Lx
	POINT U	60 Lx	80 Lx	80 Lx	90 Lx
	POINT V	70 Lx	80 Lx	100 Lx	90 Lx

3.2 Result and Discussion

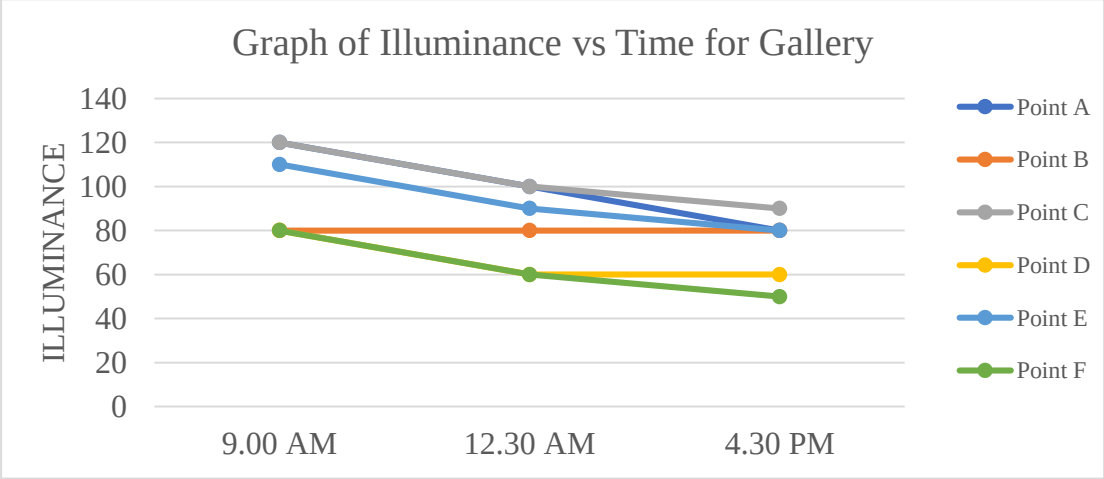

Figure 3: Graph for gallery room

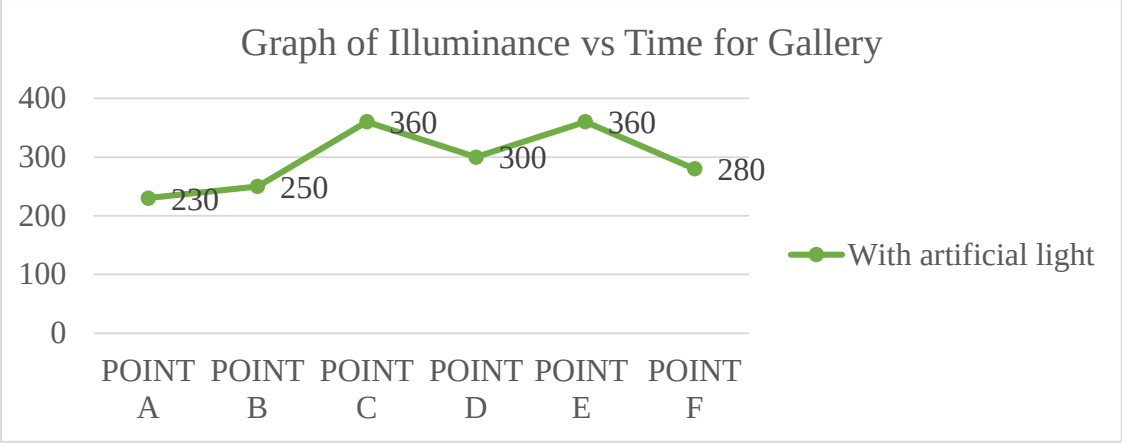

Figure 4: Graph for artificial light illuminance in gallery room

Based on figure 1 and 2, for lobby and gallery shows the grid would be divided into 6points, during 9.00 am, the reading shows around 80Lx to 120Lx for natural light. With addition of artificial light, it shows the increasing of illuminance to 230Lx to 300Lx. Compared to outdoor lighting which is 1200Lx it shows that the natural lighting at point B, D and F is slightly lower because it is caused by the limited opening in the area, for point B it caused by the location of the windows that is not directly facing the sunlight. During 12.30pm there are slightly changes in illuminance in the room which is around 60Lx to 100Lx. During 4.30pm the reading shows that the illuminance of every points is below 100Lx so it will have required the artificial lighting. It shows that the placement of windows must be strategic in order to have a good amount of natural lighting to enter the building. With additional of artificial lighting, it shows that illuminance at point A is 230Lx and highest is 360Lx at point C and E. Based on MS1525:2014, it shows that the recommended average illuminance levels for studio room is within 300Lx to 400Lx. For point A, B and F, it shows that the illuminance is not suitable for drawing room because the illuminance is only within 230Lx to 280Lx. Since point A and B has a windows, it can be determined that the cause of illuminance is from the lighting system of the point. So by increasing the amount of lighting system in this point will make sure that the illuminance is fair enough with the other points.

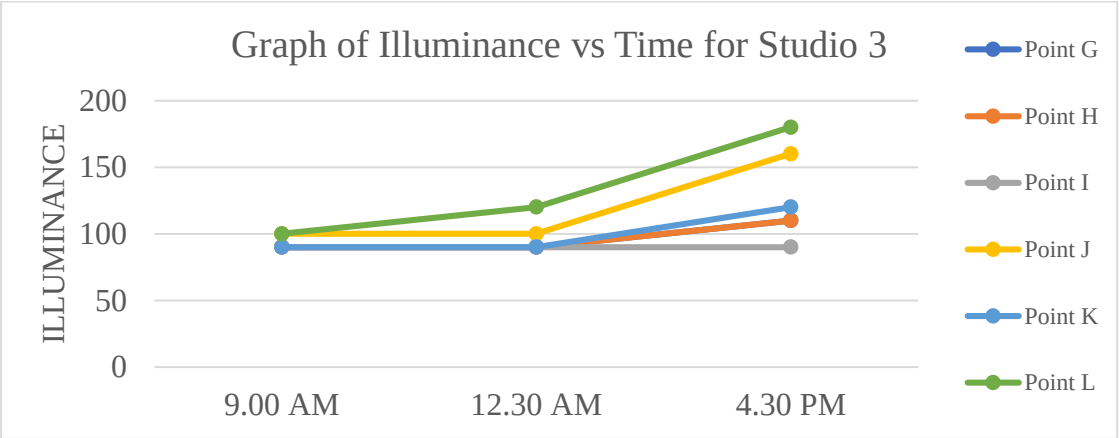

Figure 5: Graph for studio 3 room

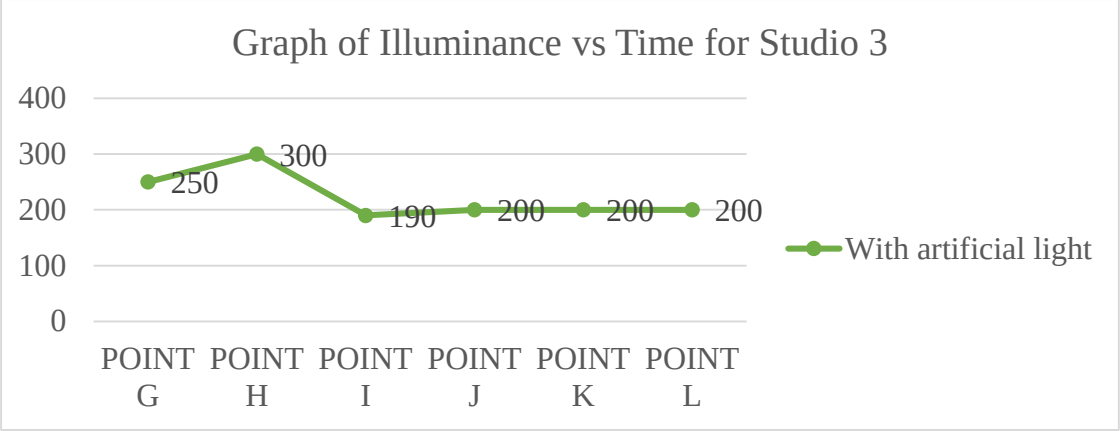

Figure 6: Graph for artificial light illuminance in studio 3

For studio 3, it is located at the ground floor which is beside the gallery space, therefore the layout of the room will be similar with the gallery room. This room will be divided into six grid and the data taken at each of the points. For figure 3, during 9.00am, it shows that the illuminance level of the room is around 90Lx to 100Lx. The value of illuminance is lower compared to the gallery room. it is because during 9.00am, the sunlight is facing the gallery room thus it will affect the indoor lighting to enter the building when it is opposite. Figure 4 shows that illuminance for this room when artificial lighting is added shows that the value is around 190Lx to 300Lx. This shows that there is certain point that are not suitable for drawing activity because it is not achieved the recommended illuminance level on MS1515:2014. For point G, J, L, it shows that the value of illuminance is still lower than the requirement on MS1515:2014 while the points are near the windows. So by adding lighting system in the point will increase the acceptable illuminance that required. For points K, it shows the area at point K is far from any openings and there is partition at the room so point K will require a good amount of artificial lighting so that it will achieve the required illuminance.

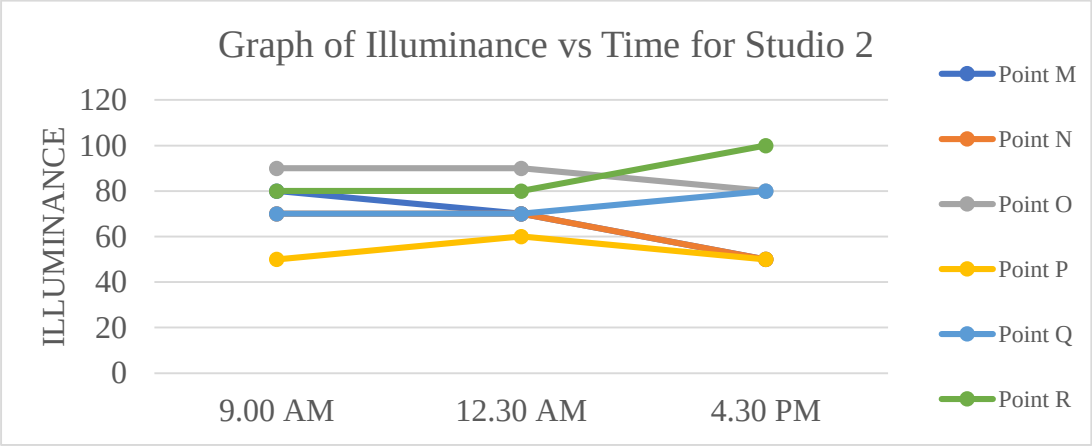

Figure 7: Graph for studio 2 room

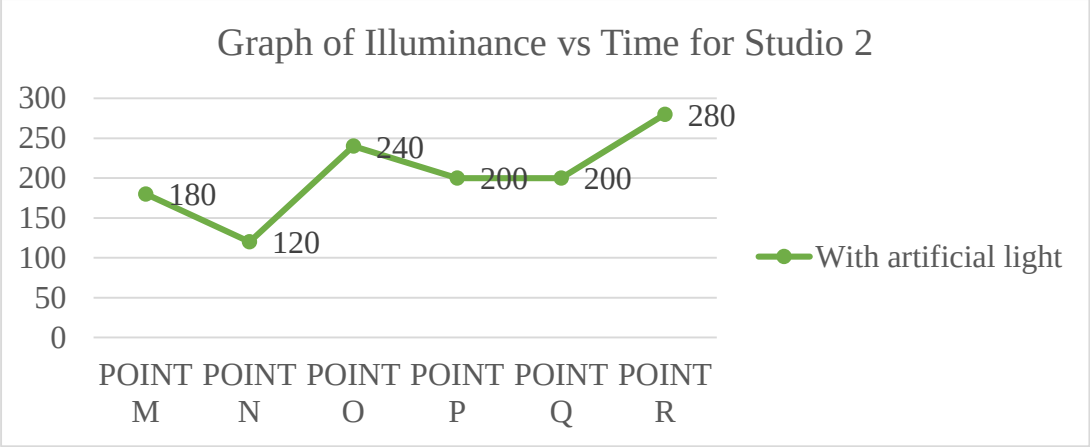

Figure 8: Graph for artificial light illuminance in studio 2

For studio 2, it shows that during 9.00am, the illuminance level on figure 5 shows that the reading is within 50Lx to 90Lx. Point P has the lowest illuminance level because based on the plan, it shows that the point S are far from any openings so that it will receive a low amount of natural lighting compared to other points. Based on the data that are recorded, it shows that the amount of natural lighting that enter the studio is not sufficient because the amount of opening of this space is limited compared to the gallery and studio 3 room. To make sure that this room is either suitable to be used as drawing room, the illuminance level will be taken with additional of artificial lighting. Based on the data, figure 6 shows that the illuminance level is within 120Lx to 240Lx. The illuminance level for each points in studio 2 is not suitable to be used as drawing room because it is not achieved the recommended average illuminance for drawing room in MS1515:2014 which require 300Lx to 400Lx of illuminance. Point N has the lowest illuminance reading because the point only depends on the artificial lighting since there is no opening for natural lighting to enter the area. By adding lighting system in this studio will solve the low illuminance level or the studio need to be replaced with a strategic location such as gallery or studio 3 room which is located at the corner lot of the building.

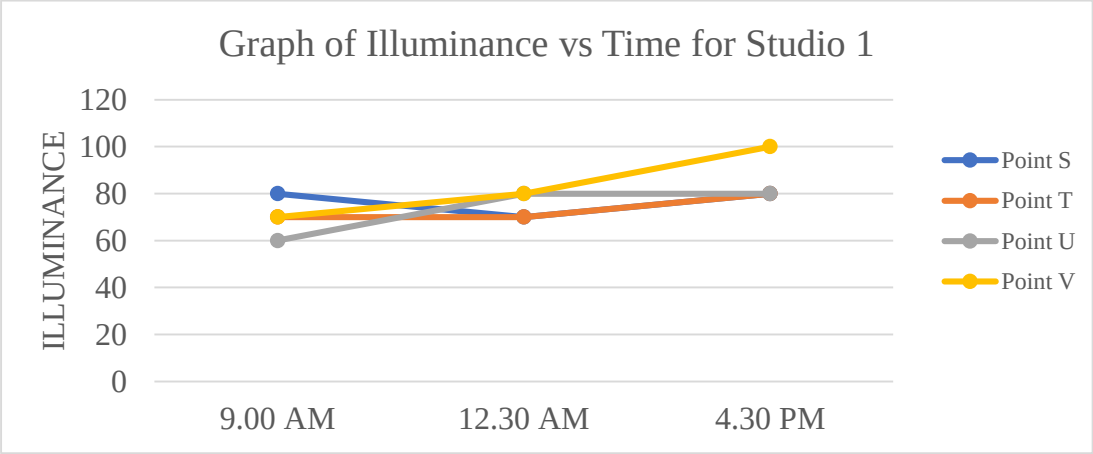

Figure 9: Graph for studio 1 room

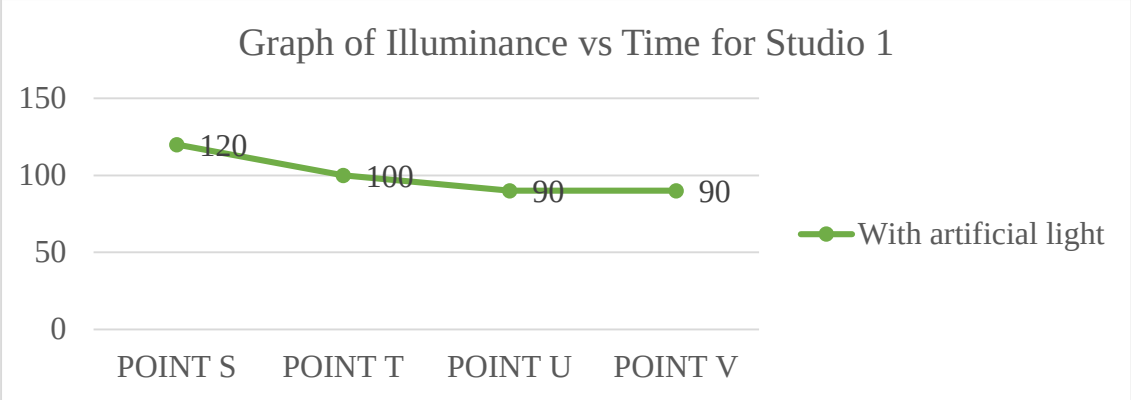

Figure 10: Graph for artificial light illuminance in studio 1

Studio 1 is located at first floor. The layout of this studio is more to rectangular and the area is smaller compared to other studio. The points would be divided into four points and the data would be taken in each points. During 9.00am, figure 7 shows that the illuminance level of the room is within 60Lx to 80Lx. Point U has 60Lx of illuminance because it is located at the middle of the room so there is less amount of natural lighting to enter. During 12.30pm it shows that the illuminance is within 70Lx to 80Lx. It shows that studio 1 can accept only 80Lx during noon so it will require artificial lighting so that drawing work can be proceeding. During 4.30pm it shows that the illuminance for all points only have slightly changes except for point V since the sunlight is facing the windows at point Y. it shows the studio 1 only get maximum of 100Lx of illuminance which is required an artificial light. After data taken, figure 8 shows point V has the highest illuminance of 120Lx while point U and V is the lowest with only 90Lx. Based on MS1515:2014, it shows that the studio 1 is not suitable to be used as a drawing room because based on the plan. It shows that the shape of the room is rectangular and the location of the room is right in the middle of the building. It makes the amount of windows required is limited. It will affect the illuminance for each points and the lighting system also affect the room since it is not achieved the minimum requirements for drawing room. Studio 1 cannot be used as a drawing room unless the lighting system in the room will be added to increase the illuminance level or by changing the studio location to the corner lot so that it will receive more natural light to balance with illuminance of the artificial lighting in the building.

4. Conclusion

Based on the results, there are four room that are used as studio room in Kampus Bandar building. To check the lighting quality of the room, lux meter is used to take the illuminance level on each room. Each room will be divided into several grids so that the data taken are accurate. Based on the data taken, it shows that the quality of each studios is inadequate and the illuminance level of each room is different. There is studio that are not suitable to be used as studio room because the lighting quality is low.

To make sure that the lighting quality of studio room is suitable to be used, the illuminance level must be compared to the MS1515:2014. Based on the data taken. It shows that every studio need to depends on the artificial lighting so it can reach the suitable illuminance which is in 300Lx to 400Lx. Studio 3 and gallery are suitable to be used as studio room while studio 2 and studio 1 is not because the illuminance level is not meet the average requirement in MS1515:2014.

The studio room in Kampus Bandar can be improved by adding the artificial lighting in each studio so that the illuminance level will reach the average requirements for drawing room. For gallery and studio 3, there are several points that has a lower illuminance. To fix the problem, it is either adding more artificial light into the points that has lower illuminance or by moving the drawing table into the other points that has a suitable illuminance. For studio 1 and studio 2, there is major solution that need to be made since the opening in this room is limited, it is by adding the artificial light into each room that will help to increase the illuminance level of the room or by moving the location of both studios into the corner lot of the building, so that it will have a better quality lighting.

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