EVALUATION OF LIBRARY LIGHTING OF THE UNIVERSITY OF MUHAMMADIYAH LAMONGAN BASED ON LIGHT INTENSITY MAPPING AS AN EFFORT TO REDUCE EYE FATIGUE

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DOI : https://doi.org/10.52060/hmaps.v2i1.2076

ABSTRAK

Perpustakaan merupakan salah satu aspek penting yang dimiliki perguruan tinggi yang melibatkan pencahayaan dalam pemanfaatannya. Pemenuhan kebutuhan intensitas sesuai dengan standar dapat membantu mengurangi gangguan penglihatan, salah satunya kelelahan mata. Tujuan dari penelitian ini adalah untuk mengevaluasi pencahayaan di perpustakaan Universitas Muhammadiyah Lamongan. Metode penelitian ini adalah dengan mengambil data tunggal menggunakan luxmeter kemudian data intensitas cahaya yang diperoleh dipetakan dalam bentuk peta kontur. Hasil penelitian menunjukkan bahwa nilai intensitas cahaya di perpustakaan Universitas Muhammadiyah Lamongan telah memenuhi SNI pencahayaan perpustakaan yaitu berada pada kisaran 300 lux, karena nilai intensitas rata-rata >300 lux baik pada zona 1 maupun 2. Kesimpulan dari penelitian ini adalah intensitas cahaya di ruang baca perpustakaan Universitas Muhammadiyah telah memenuhi standar SNI namun masih memerlukan nilai intensitas cahaya yang dapat dijadikan pembanding agar data yang diperoleh lebih akurat, data tersebut dapat berupa data hasil pengukuran sensor maupun pengukuran berulang.

Kata Kunci: Intensitas Cahaya; Perpustakaan; Kelelahan Mata

ABSTRACT

Libraries are an important aspect that universities have that involve lighting in their use. Meeting the needs of intensity in accordance with standards can help reduce vision problems, one of which is *eye fatigue*. The purpose of this study is to evaluate lighting in the library of the University of Muhammadiyah Lamongan. The method of this research is to take a single data using a luxmeter and then the light intensity data obtained is mapped in the form of a contour map. The results of the study showed that the light intensity value in the library of the University of Muhammadiyah Lamongan had met the SNI of library lighting, which was in the range of 300 lux, because the average intensity value was >300 lux in both zones 1 and 2. The conclusion of this study is that the light intensity in the reading room of the University of Muhammadiyah library meets the SNI standard but still requires a light intensity value that can be used as a comparison so that the data obtained is more accurate, the data can be in the form of sensor measurement data or repeated measurements.

Keywords: Light Intensity; Library; *Eye Fatigue*

Volume 2 No 1 (2024)
E-ISSN : 2987-5471
P-ISSN : xxxx-xxxx

BACKGROUND

The library is an important room in a university. According to Law No. 43, a library is an institution that collects printed and recorded knowledge, manages it in a special way to meet the intellectual needs of its users. In general, libraries contain bookshelves and reading rooms. In a library, light is the main aspect that supports the absorption of knowledge by library users. The existence of good lighting in the library will have an impact on the interest of visitors to come to the library. Lighting in a room is the intensity of illumination or illumination level needed for activities. In Indonesia, light intensity standards in libraries have been regulated. According to the Indonesian national standard (SNI), the minimum standard for lighting levels in libraries is 300 lux. This is because lighting is an important and valuable aspect when designing a room so that it can function properly, libraries for example. Inadequate lighting quality can have adverse effects on visual function. (Kurniasih et al., 2019; Rezka A s at , 2019) (Parera et al., 2019) (Milaningrum, 2015) (Putra et al., 2021; Salehuddin & Latupeirissa, 2017) (Chasanah & Widodo, 2023; Datangeji et al., 2019)

Good lighting is when the eyes can see what is around clearly. In other words, good lighting is lighting that meets functional requirements as well as environmental requirements. Light is an electromagnetic wave that is important for human life because without light life on earth cannot develop. Humans need light to visually detect objects. The eyes, nerves and visual nerve centers in the brain are organs that have an impact on vision. Indoor lighting is essential for creating a healthy room. Each color on the wall of the room has the potential to provide a different reflection factor. Natural lighting is a dynamic lighting system that takes into account the heat load, glare and the availability of sunlight in the room. Natural light can be produced directly by sunlight. (Kurniasih et al., 2019; Wisnu & Indrawanto, 2017) (Kim et al., 2020) (Kim et al., 2020)

The intensity of light or illumination is the amount of energy received on a surface per unit area and time. Light intensity measurements can be affected by the measurement time. The difference in light intensity during the day is greater when compared to in the morning and evening so that it can cause a difference in the number of sunlight intensity (Putra et al., 2021) . In addition, the results of measuring light intensity can be influenced by the distance of the luxmeter to the light source and the area of the room used, the larger the room and the farther the distance between the luxmeter and the light source, the smaller the intensity. The University

of Muhammadiyah Lamongan has a library with a design with 2 zones where each zone consists of a reading room and bookshelves.

On each side of the zone there are windows, so that during the day sunlight can enter. The purpose of this study is to analyze the intensity of light in the library at the University of Muhammadiyah Lamongan. So that it can determine the right position for the reading room and rearrange the position of the reading room in the library. This can help library users to use the library properly without causing problems such as (Listiana Cahyantari, Rif'ati Dina H, 2016) (Chasanah & Widodo, 2023) *eye fatigue* due to lack of adequate lighting.

METHOD

The research on the evaluation of library lighting at the University of Muhammadiyah Lamongan is based on light intensity mapping as an effort to reduce *eye fatigue* using two methods, namely the creation of a contour map of the distribution of light intensity in the library room. The research method used is the creation of a contour map of the distribution of light intensity in the library room at the University of Muhammadiyah Lamongan. In this method, field measurements are carried out first as a reference for making contour maps. The required field measurement data is the light intensification value (Lux) in the classroom.

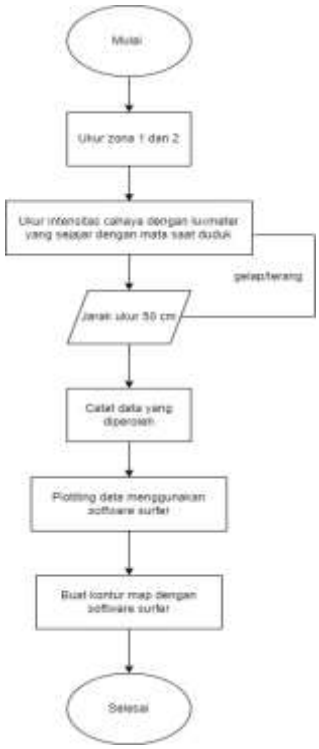

Figure 1. Flow chart of research methods

Volume 2 No 1 (2024)
E-ISSN : 2987-5471
P-ISSN : xxxx-xxxx

Light intensity measurement using Aneng GN201 type luxmeter equipment (Figure 2) that is already available on the market and rollmeter with the following steps:

1) Measure the dimensions of space with a rollmeter and then divide it into several grids of coordinate points with a distance of 50 cm between points. The existing dimensions of the room in zone 1 have a room length of 15.9 m and a width of 6.6 m. Meanwhile, in zone 2 it has a length of 13.94 m and a width of 6 cm. The light source used is a natural light source, namely from sunlight that enters through windows on each side of the library space zone.

2) Measure the light intensity at the coordinate point with the Luxmeter height parameter from the floor at the height of the student's sitting position when sitting and parallel to the eyes;

3) The light intensity data at each coordinate is recorded and used for the creation of light intensity contour maps.

Figure 2. Luxmeter type Aneng GN201

RESULT

Based on the measurement results in table 1, in zone 1, data on light intensity values of 98 light intensity values were obtained, which were in the range of 33.9 lux to 8,852 lux. Meanwhile, in zone 2, which can be seen in table 1, 78 light intensity value data were obtained with a value range of 109.6 lux to 4,716 lux. The measurements made in this study are single measurements, where the data obtained is more varied at each coordinate point.

Table 1. Light Intensity Data in Zone 1 and Zone 2

No.	Zone 1 Light Intensity (Lux)	Zone 2 (Lux) Light Intensity
1	397,6	260,6
2	370,7	298,6
3	494,2	302,3
4	104,1	342,8
5	368,2	391,7
6	244,4	369,3
7	218,7	464,7
8	312,6	538
9	482,5	715,3
10	431,4	1138
11	485,2	2484
12	738,8	4475
13	1073	423,4
14	386	501,1
15	266,9	667,8
16	607,2	1021
17	891,5	2249
18	1302	4716
19	2250	372,3
20	33,9	396,5
21	1297	610
22	329,9	863,7
23	537,6	998,6
24	703,5	384,1
25	898	285
26	1301	319,6
27	1905	382,9
28	940,1	438,6
29	276,4	435,5
30	451,4	325,2
31	618,6	234,7
32	626,9	264,5
33	776,9	280,2
34	841,3	359,6
35	575,5	274,5
36	165,5	238,9
37	178,1	219,4
38	181,7	217,8
39	205,6	232,2

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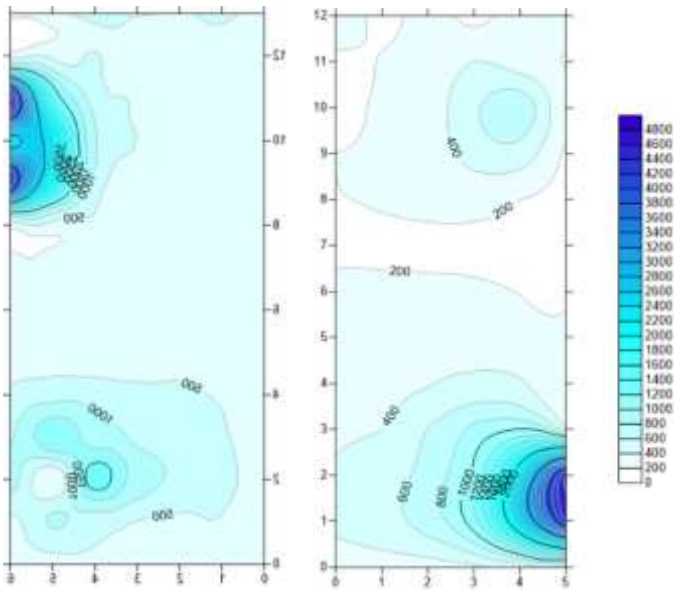
E-ISSN : 2987-5471
P-ISSN : xxxx-xxxx

40	185,1	228,7
41	159,6	196,3
42	154,3	165
43	95,8	186,5
44	190,3	187,2
45	209,6	168,8
46	221,5	163,3
47	241,4	150,6
48	230,9	109,6
49	196,9	198,4
50	92	207,8
51	181,7	241,6
52	214,8	262,4
53	232,9	198,2
54	211,5	126,8
55	213,6	201,3
56	203,2	219,8
57	130,4	272,1
58	251,5	489
59	318,1	530,9
60	349,5	159
61	397,5	153,3
62	312,2	225,5
63	222,1	282,8
64	190,2	570,1
65	235,2	831,4
66	388,5	220,1
67	381	167,4
68	756,9	206,1
69	3463	269,4
70	7880	407,1
71	180,2	269,5
72	314,3	181,4
73	227,7	319,7
74	490,5	151,7
75	1064	256,1
76	4075	140,5
77	4329	263,2
78	367,4	275,1

From the results of these measurements, data plotting was made using surfer software. The results of the zone 1 plot can be seen in figure 3a, where the intensity value is greater than or equal to ≥ 500 lux. The plotting shows that the light intensity ≥ 500 lux is near the library window, when viewed based on the library design or research location. The darker the blue color, dark blue, the higher the intensity value. Meanwhile, in zone 2, the point shaded in blue starts at an intensity value of ≥200 lux. As can be seen in figure 3b, the older the blue color, the higher the light intensity value. The plot produced by the surfer, shows the high light intensity value near the library window when viewed based on the design and layout of the library.

Based on the results of measurements and plotting of the resulting data, it can be seen if the light intensity value in the library is in the range of ≥ 300 lux, both in zone 1 and zone 2. This indicates that the library of the University of Muhammadiyah Lamongan meets the minimum standard (SNI), which is 300 lux. The intensity value that is below < 300 lux, is the value of the light intensity in the part of the room that is enclosed or blocked by poles and bookshelves. In addition, values below < 300 lux, due to the different data collection times, namely data collection is carried out in the afternoon and evening. However, even though it has met the SNI, the library of the University of Muhammadiyah Lamongan still needs the light intensity value used as a guideline and comparative data to find out the errors in this study so as not to cause eye problems due to lack or excess light entering when reading books in the reading room.



Volume 2 No 1 (2024)
E-ISSN : 2987-5471
P-ISSN : xxxx-xxxx

(a) (b)

Figure 3. (a) Zone 1 light intensity contour map, (b) Zone 2 light intensity contour map

AUTHOR CONTRIBUTIONS

Vanis Aisyatul AS as the first author and corresponding author plays a role in literature search, literature assessment and literature review writing. Uswatun Chasanah plays a role in helping to find sources of literature to be reviewed. Latidatun Nur Aini and Rohmatul Badiyah plays a role in assisting in the process of assessing and screening articles which will then be reviewed in this study.

CONFLICT OF INTERESTS

There is no conflict of interest in this study.

ACKNOWLEDGEMENT

The researcher is very grateful to the team who has helped and contributed more to this research. In addition, he also expressed his gratitude to the supervisor, for always accompanying and guiding the researcher and team from the beginning until the writing of this article.

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