SeAMK

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Illumination measurements

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1 ABSTRACT

The work will familiarize by means of experimental methods the basic concepts of photometry and relating phenomina. We will measure illuminance at 15 … 20 points at the level of table surface of a bright room was determined by using a luxmeter. Illuminance given in lux (lx) is a measure for luminous intensity arriving on a target illuminated. Illuminance is measured by using a luxmeter. After that the iso-lux curves of the room with interval of 100 lux will be done.

2 INTRODUCTION

2.1 Background

Illuminance, the measurement of the amount of light falling onto (illuminating) and spreading over a given surface area (konica minolta, n.a), is a critical concept in lighting design and engineering. For decades, researchers have studied illuminance to better understand how light interacts with the built environment and how it affects human health and wellbeing. The history of illuminance research dates back to the early 20th century, when scientists first began to study the effects of electric lighting on human physiology and behaviour (Optics & Photonics News - June 2008, n.d.)

2.2 Purpose

Since then, advances in technology and new research findings have shed light on the complex relationship between illuminance and human health. Studies have shown that insufficient or excessive illuminance can lead to a range of negative health outcomes, such as disrupted circadian rhythms, sleep disturbances, and eyestrain (Figueiro, 2017). As a result, the field of lighting design has shifted towards a more human-centric approach, emphasizing the importance of providing lighting that supports health and wellbeing.

2.3 Content of the work

This lab report explores the principles of illuminance and its relation to lighting design, measuring its levels in different conditions and analysing the effects on visual comfort and task performance. We'll also investigate how different light sources affect illuminance and potential health effects

3 Theory

3.1 Theory and principle related to the work

Activity	Illuminance *(lx, lumen/m^2)*
Public areas with dark surroundings	20 - 50
Simple orientation for short visits	50 - 100
Areas with traffic and corridors - stairways, escalators and travelators - lifts - storage spaces	100
Working areas where visual tasks are only occasionally performed	100 - 150
Warehouses, homes, theaters, archives, loading bays	150
Coffee break room, technical facilities, ball-mill areas, pulp plants, waiting rooms,	200
Easy office work	250
Class rooms	300
Normal office work, PC work, study library, groceries, show rooms, laboratories, check-out areas, kitchens, auditoriums	500
Supermarkets, mechanical workshops, office landscapes	750
Normal drawing work, detailed mechanical workshops, operation theaters	1000
Detailed drawing work, very detailed mechanical works, electronic workshops, testing and adjustments	1500 - 2000
Performance of visual tasks of low contrast and very small size for prolonged periods of time	2000 - 5000
Performance of very prolonged and exacting visual tasks	5000 - 10000
Performance of very special visual tasks of extremely low contrast and small size	10000 - 20000

basic assumptions and approximations of the theory

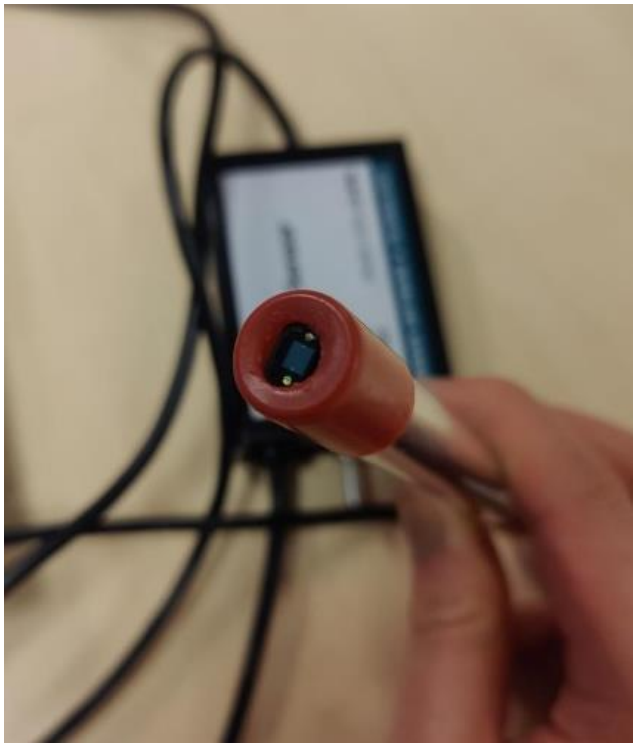
result that is tested by measurement

4 Equipment and measurements

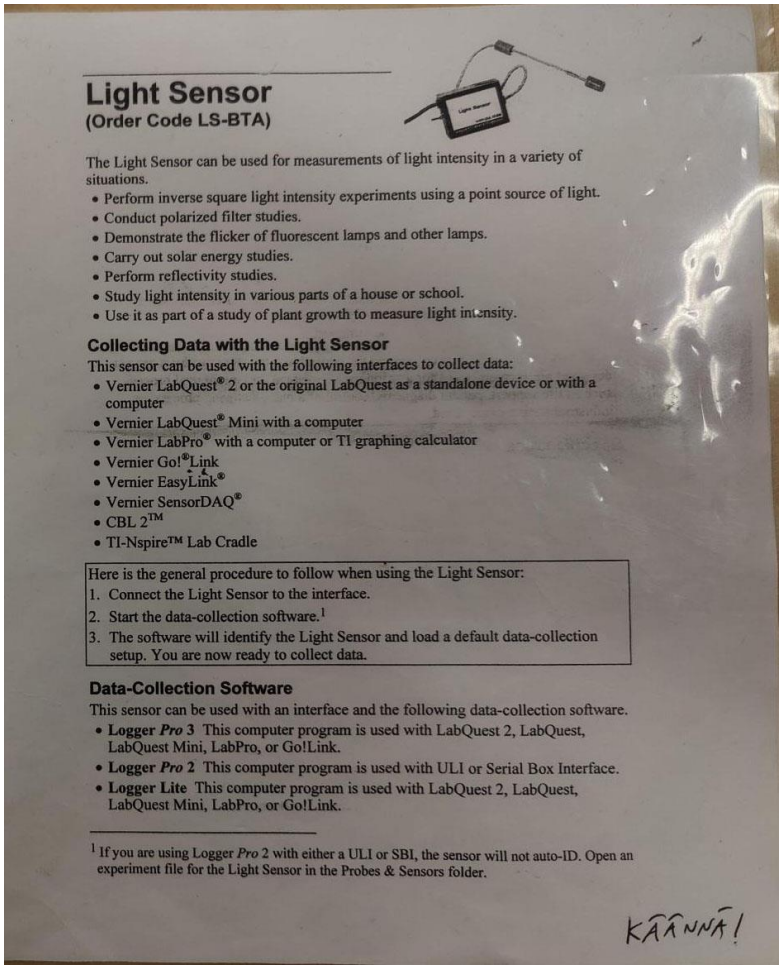
4.1 Measuring equipment

We used a Luxmeter (light sensor) to measure the light intensity in this experiment.

Vernier Luxmeter



Luxmeter’s sensor



Light Sensor
(Order Code LS-BTA)

The Light Sensor can be used for measurements of light intensity in a variety of situations.

- Perform inverse square light intensity experiments using a point source of light.
- Conduct polarized filter studies.
- Demonstrate the flicker of fluorescent lamps and other lamps.
- Carry out solar energy studies.
- Perform reflectivity studies.
- Study light intensity in various parts of a house or school.
- Use it as part of a study of plant growth to measure light intensity.

Collecting Data with the Light Sensor

This sensor can be used with the following interfaces to collect data:

- Vernier LabQuest® 2 or the original LabQuest as a standalone device or with a computer
- Vernier LabQuest® Mini with a computer
- Vernier LabPro® with a computer or TI graphing calculator
- Vernier Go!®Link
- Vernier EasyLink®
- Vernier SensorDAQ®
- CBL 2™
- TI-Nspire™ Lab Cradle

Here is the general procedure to follow when using the Light Sensor:

1. Connect the Light Sensor to the interface.
2. Start the data-collection software.[1]
3. The software will identify the Light Sensor and load a default data-collection setup. You are now ready to collect data.

Data-Collection Software

This sensor can be used with an interface and the following data-collection software.

- **Logger *Pro* 3** This computer program is used with LabQuest 2, LabQuest, LabQuest Mini, LabPro, or Go!Link.
- **Logger *Pro* 2** This computer program is used with ULI or Serial Box Interface.
- **Logger Lite** This computer program is used with LabQuest 2, LabQuest, LabQuest Mini, LabPro, or Go!Link.

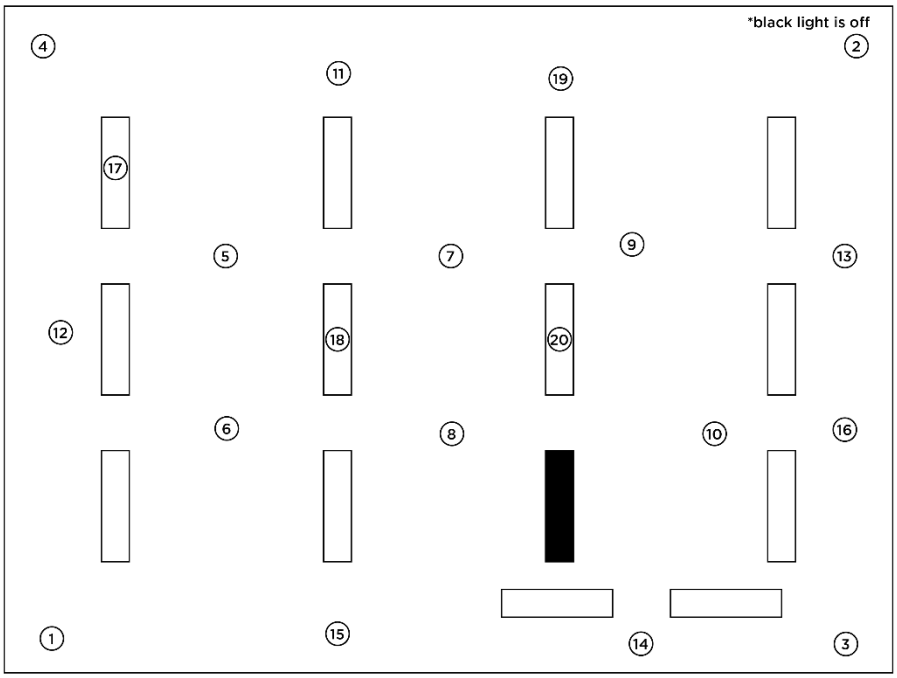
[1] If you are using Logger *Pro* 2 with either a ULI or SBI, the sensor will not auto-ID. Open an experiment file for the Light Sensor in the Probes & Sensors folder.

KÄÄNNÄ!

4.2 Measurements

Before the measurement, we got ourselves familiar with the luxmeter and its features. The luxmeter has a switch on the outer box that is used to select the range in which we want to measure. The switch has 3 modes: 0 - 600 lux range, 0 – 6000 lux range, and 0 – 150000 lux range. In our case, as we were measuring normal indoor light (the classroom), we used the 0 – 6000 lux range for the measurements.

According to the instructions, we then made a rough layout picture of the ceiling of the room, from which all our light sources are from. We picked 20 measuring points at the level of the table surfaces, like in the picture below



When doing the measurements, we tried to avoid our own shadows for more accuracy. The results would then be recorded into a table

After having done the point measurements, we then again measured more positions of the room at the level of the table surface. These measurements were used to illustrate the iso-lux curves of the room in an interval of the room. The iso-lux curves were then drawn on the lay-out of the room, the same one used for the previous measurements.

5 Result

The results of the 20 point measurements are recorded in the table below.

Position	Illuminance/lux
1	116
2	265
3	230
4	215
5	500
6	580
7	510
8	350
9	435
10	425

Position	Illuminance/lux
11	315
12	470
13	465
14	450
15	310
16	380
17	455
18	470
19	355
20	500

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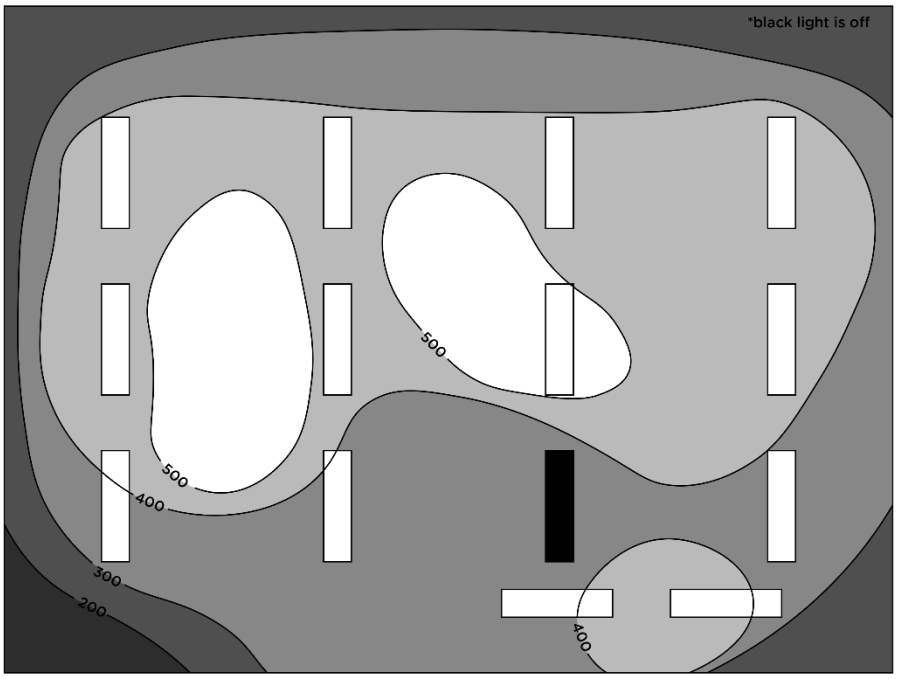
The iso-lux curves are drawn on the map for the second measurements. Colors (greys) are also used to help illustrate the illuminations area clearer.



6 Conclusions (Reflection)

Based on our analysis and cross-referencing with the recommended/advisable illuminance table, we have determined that the illuminance levels in our classroom are sufficient for study and working. We carefully examined how well the obtained result corresponds to the image of the studied phenomenon and concluded that the result makes sense, given that most tables used for studying have around 400lux of light sources. Overall, our analysis indicates that the illuminance levels in our classroom meet the recommended standards for study and working.

7 References (Literature references / Sources)

Konica Minolta Sensing Americas. (2020, February 7). *Luminance vs. Illuminance*. Konica Minolta Sensing. https://sensing.konicaminolta.us/us/blog/luminance-vs-illuminance/

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